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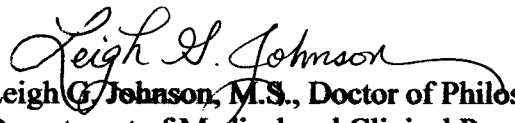

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ABSTRACT

Title of Dissertation: Problem Solving and Emotional Distress Among Brain and Breast Cancer Survivors

Leigh G. Johnson, M.S., Doctor of Philosophy, 2007

Thesis directed by: Michael Feuerstein, Ph.D., MPH

Director of Clinical Training

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Objective: The specific aim of the current study was to examine, and contrast, the relationship between problem solving and emotional distress among brain and breast cancer survivors, while statistically controlling for demographics, treatment-related factors, physical fatigue and cognitive limitations.

Methods: An on-line questionnaire was used to gather demographic and treatment-related information from 138 brain tumor survivors, 148 breast cancer survivors, and 149 non-cancer comparison participants. The questionnaire included embedded measures which were used to assess depression, anxiety, general emotional distress, physical fatigue, cognitive deficits, and problem solving. A series of multivariate hierarchical linear regression analyses were run to: 1) determine whether problem solving was significantly associated with depression, anxiety, and general emotional distress among brain and breast cancer survivors; 2) compare the levels of psychological distress reported by brain and breast cancer survivors; and 3) determine whether problem solving was more strongly related to psychological distress among brain or breast cancer survivors.

Results: Cancer survivor participants reported an average of 5 years since their diagnosis of cancer. Although the levels of depression, anxiety, general emotional distress, fatigue, and cognitive limitations reported by brain and breast cancer survivors were not clinically elevated, they were significantly greater than that reported by non-cancer comparison participants. Deficits in problem solving were significantly associated with depression, anxiety, and general emotional distress among both brain and breast cancer survivors, after statistically controlling for demographics, treatment-related factors, fatigue, and cognitive limitations. Problem solving was more strongly associated with anxiety among breast cancer survivors than among brain tumor survivors. A consistent relationship was found between the reported use of medication for mood management and heightened levels of distress.

Conclusions: These findings suggest that: 1) the relationship between problem solving and psychological distress is greater than had previously been established; 2) brain tumor survivors (or a subset thereof) might benefit from cognitive rehabilitation prior to, or in conjunction with, the use of interventions (such as Problem-Solving Therapy (PST)) that rely heavily upon one's cognitive abilities; 3) long-term survivors of brain and breast cancer would benefit from better screening and treatment of their psychological distress symptoms.

TITLE PAGE

PROBLEM SOLVING AND EMOTIONAL DISTRESS AMONG BRAIN AND BREAST CANCER SURVIVORS

by

Leigh G. Johnson

Dissertation submitted to the faculty of the

Department of Medical and Clinical Psychology

Graduate Program of the Uniformed Services University

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Doctor of Philosophy

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Introduction

Cancer is the second leading cause of death in the United States, with approximately 1.3 Americans newly diagnosed with cancer each year (U. S. Cancer Statistics Working Group, 2004). In recent years, there has been a dramatic increase in the number of individuals having survived cancer. This increase is attributable to a rapidly aging population, accelerating population growth, earlier disease detection and the development of more advanced treatments (Coebergh & van der Heijden, 1991; National Cancer Institute, 1998). The number of individuals surviving cancer five or more years following treatment increased from 25% in 1960 (Mullan, 1985) to 49.6% in 1976 (Ries, Eisner, & Kosary, 2004) to 64.1% in 2000 (Centers for Disease Control and Prevention, 2004). As a result, the cancer survivor population increased from 3 million in 1971 to 9.8 million in 2001 (Rowland, Mariotto, & Aziz, 2004; U. S. Cancer Statistics Working Group, 2004).

In parallel with improved survival rates in many types of cancer, there is an increasing emphasis on optimizing long-term function in cancer survivors. Attention for the societal reintegration of cancer survivors has increased dramatically (Spelten, Spranger, & Verbeek, 2002). Although the medical management of cancer is primarily centered on lowering patient mortality, problems remain regarding subtle, long-term physical and psychosocial effects of the cancer diagnosis and treatment on areas related to quality of life. Regardless of the type of cancer, cancer has a substantial impact on health status, depression, and overall quality of life (Bodurka-Bevers, Basen-Engquist, & Carmack, 2000; Crom, Chathaway, Tolley, Mulhern, & Hudson, 1999; Ganz, Rowland, Desmond, Meyerowitz, & Wyatt, 1998; Hopwood & Stephens, 2000; Ramsey, Anderson,

& Etzioni, 2000) of many cancer survivors. A recent population-based study documented that cancer survivors had more lost work and had greater health limitations than a matched healthy comparison group over a ten year period (Yabroff, Lawrence, Clauser, Davis, & Brown, 2004). Accordingly, research in the realm of "cancer survivorship" considers not only the absence or control of disease but also restoration of the survivor so that roles within the family, the community, and the workplace can be maximized (Clark & Landis, 1989). However, re-entry to these roles continues to be a challenge faced by some cancer survivors (Bigatti & Wagner, 2003; Feldman, 1984; McKenna, 1986; Rosenbaum, 1982; Spelten, Sprangers, & Verbeek, 2002). Clearly, more attention must be paid to the long-term effects of a cancer diagnosis on quality of life.

Important differences in survival patterns exist between diagnostic groups. For example, although survival rates have improved in recent years for all cancer types, the five-year survival rate for breast cancer is now 88%, in stark contrast to a five-year survival rate of 30% among brain cancer survivors (Note: these statistics are collapsed across cancer types within diagnostic categories). Brain cancer is a unique type of cancer because, due to the location of the tumor, the pathology and treatment of brain cancer directly affect the brain, which can in turn directly impact both physiological and psychological aspects of functioning and quality of life through direct impact on biobehavioral processes. In contrast with breast cancer, many psychological aspects of brain cancer survivorship have not been well studied. The differences between breast and brain cancer may help clarify the impact of cancer type (different pathology and anatomy) and treatment on symptoms commonly associated with cancer survivorship.

The proposed research will leverage these differences through a comparison of brain and breast cancer survivors.

Despite the negative consequences of unrelieved symptoms (such as emotional distress, fatigue, or pain) in patients with cancer, a recurrent theme in the research literature is that these symptoms are not adequately evaluated (von Roenn, Cleeland, Gonin, Hatfield, & Panda, 1993; Ward, Goldberg, Miller-McCauley, Mueller, Nolan, & Pawlik-Plank, 1993), or managed (Cleeland, 1998; Cleeland, Gonin, Hatfield, Edmonson, Blum, & Steward, 1994). The number of research studies on effective interventions for pain, fatigue, and depression in cancer survivors remains modest (Miaskowski, Dodd, & Lee, 2004). The deficits in symptom management research are considerable, particularly in the areas of mechanisms, developmental perspectives, trends across stages of the natural history of cancer, disease-specific considerations, and effective interventions (Miaskowski et al, 2004).

A recent meta analysis investigated the effects of cognitive behavioral therapy (CBT) and patient education (PE) on problems commonly reported in adult cancer survivors such as depression, anxiety, pain, physical functioning, and quality of life (QOL) (Osborn, Demoncada, and Feuerstein, 2005). Results of this meta-analysis indicate that CBT is effective for the short term management (< 8 months) of depression, anxiety and improvement of quality of life among cancer survivors. However, the meta-analysis also revealed that, beyond 8 months (i.e., the median follow-up period of the studies reviewed), the impact of CBT on depression and anxiety among cancer survivors was no longer significant. These findings provide additional support for the importance of research centered on specific long-term correlates of the cancer diagnosis (such as

depression and anxiety) in order to better understand the factors that may be impacting these outcomes.

In the following sections, cancer is first defined and described, and the epidemiology related to brain and breast cancer is reviewed. An operational definition of cancer survivorship is provided. Symptoms commonly associated with cancer survivorship, including fatigue, cognitive limitations, and emotional distress, are reviewed. The concept of problem solving is introduced, and its relevance to emotional distress and use as a clinical intervention in cancer survivors is detailed. The study design and hypotheses are presented, and the methodology used to implement the study is outlined. Finally, results and conclusions are presented.

Background

Cancer: Definitions and General Information

Cancer is defined as "a group of diseases characterized by uncontrolled growth and spread of abnormal cells" (American Cancer Society, 2005). If the spread of abnormal cells is not controlled, it can lead to death. Cancer can be caused by external factors (tobacco, chemicals, radiation, and infectious organisms), and internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism).

Stages are used to describe the extent or spread of the cancer at the time of diagnosis. A cancer's stage is based on the primary tumor's size and location in the body and whether it has spread to other areas of the body. The most common staging system assigns stages I, II, III, or IV to the cancer, with stage I representing early stage cancer and IV representing advanced stage cancer. Common treatments for most cancers

include surgery, radiation, chemotherapy, hormonal therapies, immunotherapy, or a combination of these therapies (American Cancer Society, from www.acs.com).

Brain and Breast Cancer: Epidemiology and Treatment

Brain Cancer. Brain cancer is a general term used to describe a variety of abnormal growths within the skull, each having its own biology, prognosis, and treatment (DeAngelis, 2001). Brain cancer is a unique model of cancer because the disease and treatment directly affect the brain, which can in turn directly impact both physiological and psychological aspects of functioning and quality of life. Primary malignant brain cancer is generally characterized by short-term survival and significant morbidity as the disease progresses (Meyers, 1997). Brain cancer survivors are one of the smallest groups of cancer survivors in regards to both incidence and survival rates. As a result, many aspects of survivorship among this population have not been well studied.

Brain tumors are usually treated with surgery (i.e., biopsy and/or resection) followed by chemotherapy and radiation (Giglio & Gilbert, 2003). To date, existing treatments have not significantly altered overall survival except in the case of anaplastic astrocytoma, which now has a median survival of three years (Levin, Leibel, & Gutin, 1997). The minimum survival benefit of existing treatments for brain cancer highlights the need for alternate measures of treatment outcome in this patient population that emphasize optimizing function and quality of life (QOL; Meyers & Hess, 2003).

Brain tumors are graded pathologically with a three-tier system developed by the World Health Organization (WHO; Fletcher, 2000). This grading scheme is determined as follows: tumors with nuclear abnormalities alone are classified as low grade II; tumors with nuclear abnormalities and mitotic (replication) activity are grade III; tumors with

nuclear abnormalities, mitoses, endothelial proliferation, and/or necrosis (death of surrounding tissue) are high grade IV. The WHO grading system is of prognostic value for brain tumor progression and treatment (Fletcher, 2000).

Brain tumors are further classified based on histological features, as follows: tumors of neuroepithelial tissue, meningeal tumors, primary central nervous system lymphomas, germ-cell tumors, tumors of the sellar region, and metastatic tumors (DeAngelis, 2001). Tumors of neuroepithelial tissue are divided into the categories of astrocytic tumors, oligodendroglial tumors, mixed gliomas, ependymal tumors, choroids-plexus tumors, neuronal and mixed neuronal-glial tumors, pineal parenchymal tumors, and embryonal tumors. The two main categories of glial tumors are astrocytic and oligodendroglial tumors.

Of the primary malignant brain cancers, 60% are malignant gliomas (Levin et al., 1997). These vary from well-differentiated astrocytomas (grades I and II) comprising 15% to 20% of all malignant gliomas, through anaplastic astrocytoma and oligoastrocytomas (grade III) comprising 30% to 35%, to glioblastoma multiforme (grade IV), which represent 40% to 50% of all malignant gliomas. Thus, high-grade gliomas (grades III and IV) comprise the majority (80% - 85%) of all primary brain cancer.

Astrocytomas make-up 33% of all gliomas and have an incidence rate of 3 to 4 cases per 100,000 people (DeAngelis, 2001; Fletcher, 2000). Astrocytomas are frequently diagnosed in adults in their 30's and 40's with a mean age of diagnosis at 35 years old. Approximately 80% of malignant gliomas are glioblastomas, a subtype of astrocytomas (DeAngelis, 2001). Oligodendroglial tumors make-up approximately 5 to 15% of all gliomas; however, these type of tumors may be undiagnosed and incidence

rates may actually be 19 to 25% of neoplasms. Oligodendroglial tumors are more frequently diagnosed in adult males in their 40's and 50's.

Almost all deaths (90%) from primary brain cancer occur in patients with tumorw graded at II, III, or IV. Grade IV tumors are the most aggressive, and the majority of cases with grade IV tumors will die from their cancer. Overall, only about 19% of patients with malignant gliomas will be amenable to complete surgical resection, whereas about 17% will have a biopsy only, and the remainder (64%) will undergo partial resections (Simpson, Horton, Scott, Curran, Rubin, & Fischbach, 1993). Consequently, most patients will also require radiation therapy, a modality that improves the five and ten-year survival rates in incompletely resected high-grade astrocytomas (Chamberlain & Kormanik, 1998). Adjuvant chemotherapy may be used also, but improvement in survival is modest (Chamberlain & Kormanik, 1998; Kornblith & Walker, 1988; Levin, 1999; Levin, et al., 1990). Despite the generally dismal outcome for individuals diagnosed with malignant glioma, recent treatment developments have provided some hope to this population. Recent studies suggest that treatment of malignant glioma with temozolomide (Temodar) plus radiotherapy provides a significant survival benefit compared with radiation alone and a significantly improved time to progression compared with radiation plus standard chemotherapy (Brandes & Monfardini, 2003; Quinn, Reardon, Friedman, Rich, Sampson, & Provenzale, 2003). Furthermore, Temodar is well-tolerated in elderly patients and is less toxic than standard chemotherapy (Brandes & Monfardini, 2003). Evaluation of Temodar as an adjuvant treatment for high-grade, malignant glioma is ongoing.

Grade III malignant gliomas are somewhat less aggressive than grade IV tumors. Grade III tumors are difficult to remove completely at surgery and, at recurrence, the tumor often shows higher-grade elements. While median survival is reported to be from 36 to 48 months for grade III tumors, it is about six months for grade IV tumors (Levin et al., 1997). Time to progression is longer for grade III tumors (about nine months) than grade IV tumors (about four months). After recurrence, survival times are short, with median survival in the range 6 to 10 months for patients with grade II tumors and two to three months for those with grade IV tumors. Overall, the diagnosis of high-grade glioma carries a poor prognosis for most patients. Until therapies that markedly improve survival are found, or until the idiosyncracies of new, adjuvant treatments (such as Temodar) are fully fleshed out, it is important to assess the effects of present therapies on disease burden and health-related quality of life (Osaba, Brada, Prados, & Yung, 2000).

The age-adjusted incidence rate of primary malignant brain tumor is 6.0 cases per 100,000 person-years. This rate is higher in males (7.2 per 100,000 person-years) than females (4.9 per 100,000 person-years). An estimated 18,820 new cases of primary malignant brain and central nervous system tumors were diagnosed in 2006 (10,730 in males and 8,090 in females). It was estimated that 12,820 deaths in 2006 were attributed to primary malignant brain and central nervous system tumors, and that approximately 111,212 persons were living with a diagnosis of cancer of the brain or central nervous system in the United States in 2003. The five-year relative survival rate following diagnosis of cancer of the brain is 30.5%; 29.3% for males, and 31.9 for females (SEER, 1975-2003).

Breast Cancer. Breast cancer patients currently make up the largest group of long-term cancer survivors (Arndt, Merx, Sturmer, Stegmaier, Ziegler, & Brenner, 2004) with the American Cancer Society estimating the incidence of new invasive cases at 214,460 in 2006 (American Cancer Society, *Cancer Facts and Figures*, 2006). Breast cancer ranks second among cancer deaths in women (after lung cancer). An estimated 41,430 breast cancer deaths (40,970 women, 460 men) occurred in 2006 (American Cancer Society, 2006). Mortality rates declined by 2.3% per year from 1990 to 2001 among women, with large decreases in women less than 50 years of age (American Cancer Society, 2006). These decreases are attributed to increased awareness, earlier detection through screening, and improved treatment. Depending on characteristics of the tumor (such as size and stage), treatment for breast cancer may involve lumpectomy (local removal of the tumor) or mastectomy (surgical removal of the breast) as well as removal of some of the underarm lymph nodes. Radiation therapy, chemotherapy, or hormone therapy are also commonly used. It is common for two or more methods to be used in combination.

The five-year relative survival rate for localized breast cancer has increased from 80% in the 1950s to 98% today. Overall five-year relative survival rates from the time of diagnosis are now 98% for localized disease, 81% for regional stage, and 26% for metastatic breast cancer (American Cancer Society, 2006). Survival after a diagnosis of breast cancer continues to decline beyond five years. The survival rate at ten years for all stages combined is 80% compared to 88% at five years. Because breast cancer survivors are the largest cancer survivor group (Phillips & Bernhard, 2003), a large portion of cancer survivorship literature has focused on this group.

Cancer Survivorship

The term "cancer survivor" was first introduced into the lexicon by Dr. Fitzhugh Mullan (1985), and is generally defined as "an individual diagnosed with cancer, regardless of the course of illness" (Aziz & Rowland, 2003; Mullan, 1985). An individual is considered to be a cancer survivor from the time of his or her diagnosis until death. Mullan (1985) felt strongly that dichotomizing cancer as "cured" or "non-cured" failed to adequately capture the experience of the majority of cancer survivors. Rather, Mullan (1985) proposed three phases of cancer survivorship: acute, extended, and permanent. Acute survival extends from diagnosis to the completion of the first round of treatment. During acute survival, individuals often experience elevated levels of anxiety and fear as they come face to face with their own mortality. Physical limitations, fatigue, and diminished aerobic capacity stemming from the cancer and/or the treatment regimen are common during the acute survival phase and can have a profound impact on an individual's occupational and social environment. Extended survival refers to the time period between completion of treatment and the point at which the risk of recurrence is considerably diminished. This phase is characterized by fears that the cancer will return. During this phase of survivorship it is also common for the individual to attempt to return to a state of normalcy, for example by re-engaging in activities that one had participated in prior to diagnosis. The third and final phase of survivorship is permanent survivorship, which extends from the point where the risk of recurrence is considered to be miniscule through to the end of the individual's lifetime.

While Mullan's definitions are those that are most commonly used, other definitions of cancer survivorship are sometimes utilized (Aziz & Rowland, 2003).

"Long-term cancer survivors" are generally defined as individuals who have survived for five or more years following their primary cancer diagnosis. This definition is equivalent to Mullan's description of "permanent survivorship". According to Clark and Landis (1989), in today's world cancer survivorship means "not only the absence or control of disease but also restoration of the individual to fulfilling roles within the family, the community, and the workplace". Regardless of the definition used, it is clear that cancer survivorship research is increasingly expanding its sights beyond mere medical management of the disease to seeking to improve the physical, psychosocial, and economic outcome of individuals who have a history of cancer (Steiner, Cavender, Main, & Bradley, 2004). A biopsychosocial model of cancer survivorship has been developed by Feuerstein et al. (2006) which illustrates the many factors that impact and play into cancer survivorship:

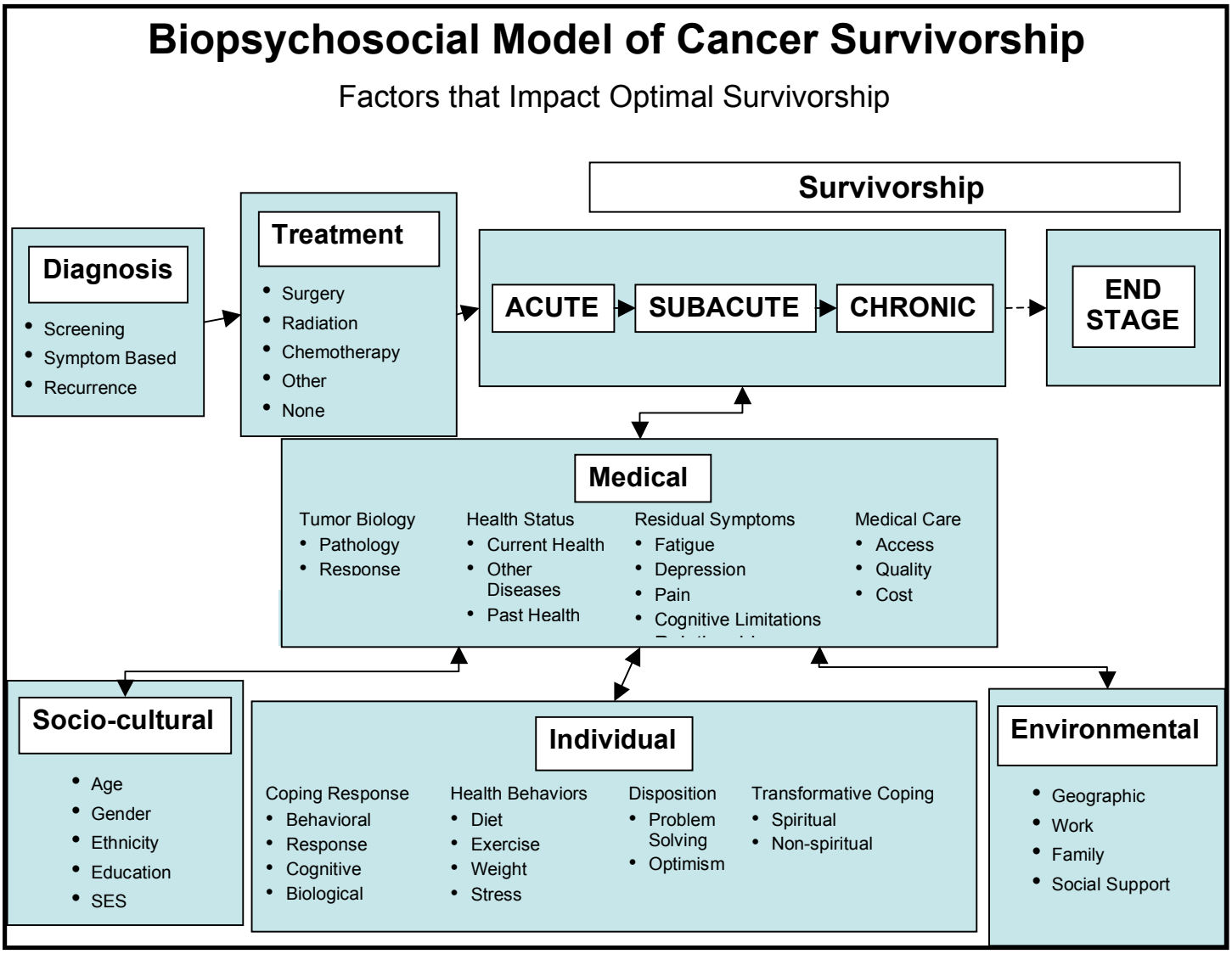


Figure 1. **Biopsychosocial model of cancer survivorship (Feuerstein, 2006)**

Correlates of Cancer Survivorship

A growing body of research is illuminating the long-term effects of a cancer diagnosis and its associated treatments. Regardless of the type of cancer, cancer has a substantial impact on health status, mental health, and overall quality of life (Bodurka-Bevers et al., 2000; Crom et al., 1999; Ganz et al., 1998; Hopwood & Stephens, 2000; Ramsey et al., 2000). Specific symptoms associated with cancer survivorship include but

are not limited to fatigue, cognitive deficits, depression, and anxiety. These symptoms can be a major problem for some patients, as well for their family caregivers (Dodd & Miaskowski, 2000). In addition, unrelieved symptoms can have negative effects on patient outcomes such as functional status, mood states, and quality of life (QOL) (Burrows, Dibble, & Miaskowski, 1998; Glover, Miaskowski, Dible, & Dodd, 1995; Miaskowski & Lee, 1999).

Patients with cancer often experience multiple symptoms simultaneously. Several groups of symptom management researchers (Dodd, Miaskowski, & Paul, 2001; Kurtz, Given, Kurtz, & Given, 1994; Miaskowski & Lee, 1999) are beginning to explore this area of symptom management research; namely, an evaluation of symptom clusters. Dodd, Miaskowski, and Paul (2001) define a "symptom cluster" as three or more concurrent symptoms that are related to each other. The nature of this relationship, however, remains to be clarified: it is possible that the symptoms in the cluster share a common etiology or mechanism, that the severity of the symptoms are correlated with one another, or that the occurrence of the symptom cluster itself results in different outcomes compared to each of the individual symptoms (Miaskowski, Dodd, & Lee, 2004). For example, preliminary work by Miaskowski et al. (2004) has noted that the symptom cluster of pain, fatigue and sleep disturbance has particularly deleterious, and specific, effects on patient outcomes (specifically, depressive symptoms, functional status, and QOL). Despite this trend towards examining symptoms of cancer survivorship in clusters, at this point in time the preponderance of cancer survivorship research has examined symptoms singularly. Three of the symptoms most commonly

associated with cancer survivorship will be reviewed below: fatigue, cognitive limitations, and emotional distress.

Fatigue. Fatigue is the most common symptom reported by cancer patients (Anderson, Getto, & Medoza, 2003), with a prevalence of nearly 80% in some tumor types (Broeckel, Jacobson, Horton, Balducci, & Lyman, 1998; Okuyama et al., 2000; Portenoy, Thaler, & Kornblith, 1994; Woo, Dibble, Piper, Keating, & Weiss, 1998). Cancer-related fatigue has been reported by cancer patients to be a major obstacle to normal functioning and a good quality of life (Portenoy & Itri, 1999).

Fatigue can be brought on by a number of factors including pain, emotional distress, sleep disturbance, anemia, de-conditioning due to lower activity level, inadequate nutrition, and most often, treatment (i.e. radiation and/or chemotherapy) itself (Cella, Peterman, Passik, Jacobsen, & Breitbart, 1998; Wagner & Cella, 2004). Fatigue is a very commonly occurring side effect of chemotherapy (Groopman & Itri, 1999; Jacobsen et al., 1999; Richardson, 1995). Moreover, fatigue is associated with the development of other chemotherapy side effects such as nausea and mouth sores (Jacobsen et al., 1999).

The National Comprehensive Cancer Network (NCCN) has identified 7 non-treatment-related factors that can contribute to fatigue in cancer patients: pain, emotional distress, sleep disturbance, anemia, nutrition, activity level, and other comorbidities (National Comprehensive Cancer Network Clinical Practice Guidelines, 2004). Fatigue has a significant relationship to depression (Stone, Richards, A'Hern, & Hardy, 2000) and pain (Bower et al., 2000). Spelten et al. (2002) observed that in a cohort of all-type cancer survivors, fatigue at six months following the first day of sick leave predicted

greater sick leave at 18 months (HR = .71; 95% CI 0.59-0.85). This relationship was independent of diagnosis, treatment, age, and gender.

Cognitive Deficits. A growing body of research has established that adults with cancer experience cognitive deficits associated with a variety of treatments including: 1) cranial radiation, 2) standard-dose chemotherapy, 3) high-dose chemotherapy and bone marrow transplantation, and 4) biologic response modifiers (Meyers, 2000; Walch, Ahles, & Saykin, 1998). Although the specific cognitive problems experienced vary from patient to patient, the most common problems reported are in the areas of concentration, memory, ability to be focused or organized, and working with numbers (Ahles & Saykin, 2001). A recent meta-analysis found statistically significant negative effect sizes in executive function, verbal memory, and motor function among adult cancer patients (Anderson-Hanley et al., 2003). These effects remained even after limiting the sample of studies to only those with relatively "less severe" diagnoses and treatments. Often, cognitive problems experienced by cancer patients are subtle. In many cases, no one except the patient knows that cognitive changes have occurred (Ahles, Saykin, & Furstenberg, 2002). Whether subtle or more pronounced, cognitive difficulties experienced by cancer patients often have a dramatic impact on cancer patients' quality of life (Ahles & Saykin, 2001).

A number of studies have shown that cancer survivors exhibit or report cognitive impairment following treatment with radiation or chemotherapy (Archibald et al., 1994, Baile, 1996; Poppelreuter et al., 2004; Tannock, Ahles, Ganz, & van Dam, 2004). Radiation therapy can affect a range of acute and chronic structural changes in the brain along with a number of symptoms (Giglio & Gilbert, 2003). These symptoms include

difficulty with reading and concentration along with a slowing of information processing, language dysfunction, attention problems, short-term memory impairment , and seizures (Giglio & Gilbert, 2003; Taphoorn & Klein, 2004). Synergistic negative effects on cognitive function also exist from the combination of radiation and chemotherapy in treatment. Cancer survivors have shown "diffuse impairments of intellectual function unrelated to the tumor site or type" (Meyers & Scheibel, 1990). Still, the relationship between type of treatment and neurocognitive outcomes remains controversial (e.g., Kaleita et al., 2004).

One would expect that directly irradiating the brain may result in some cognitive changes (Wefel et al., 2004). However, these cognitive changes are also seen in cancer survivors that did not have direct invasive cancer treatment to the brain. The phrase "Chemobrain" describes a cancer survivor's perception of cognitive change after receiving chemotherapy (Anderson-Hanley et al., 2003; Wefel et al., 2004). Chemotherapy may produce neurotoxic effects that can contribute to impaired neuropsychological functioning in various types of cancer patients (Ahles & Saykin, 2001; O'Shaughnessy, 2003; Saykin, Ahles, & McDonald, 2003). Ahles and Saykin (2001) found that breast cancer survivors experienced subtle cognitive limitations, in the domains of memory and concentration, which were associated with standard dose chemotherapy. These results also indicated the possibility of a dose-response relationship. Ahles et al. (2003) investigated the long-term (more than five years post-diagnosis) cognitive effects on breast cancer patients who received systemic chemotherapy in contrast to those who received only local therapy (surgery and local radiotherapy) found significantly lower scores in verbal memory and psychomotor

functioning. These deficits continued to be evident an average of ten years following chemotherapy. Although the majority of this research has been on breast cancer, the implications are no less profound for other forms of cancer treated by a range of chemotherapy agents. At this point in time, it is not possible to identify which chemotherapy agent(s) is (are) responsible for producing cognitive deficits, largely because chemotherapy regimens nearly always include multiple agents (Ahles & Saykin, 2001).

Studies that evaluated patients shortly after completion of chemotherapy (Komaki, Meyers, & Shin, 1995; Wieneke & Dienst, 1995) have suggested that a very high percentage of patients experience cognitive deficits (75-95%). However, other studies, that have evaluated patients two years or more post-treatment (Ahles et al., 2003; Schagen et al., 1999; van Dam et al., 1998), reported much lower rates (17-35%). This pattern suggests that the majority of patients experience cognitive problems during and immediately following treatment with systemic chemotherapy. Many potential reasons exist for these acute cognitive problems, including emotional distress associated with cancer diagnosis and treatment, other medications which can be sedating (e.g., antinausea or pain medicines), chemotherapy side effects (anemia, fatigue, chemotherapy-induced menopause, etc.), or metabolic problems associated with chemotherapy including hypercortisolism, adrenal insufficiency, thyroid dysregulation, and electrolyte disturbances (Breitbart & Wein, 1998). There are factors other than standard-dose chemotherapy which may influence cognitive functioning in cancer patients post-treatment. These include IQ and education, psychological factors (depression, anxiety,

fatigue), genetic factors, menopausal status, and use of treatments that influence hormonal levels (e.g., tamoxifen in the treatment of breast cancer).

Many studies have identified cognitive deficits in breast cancer survivors treated with chemotherapy after controlling for important confounding variables such as age, education, intelligence quotient (IQ), depression, and anxiety (Ahles & Whedon, 1999; Schagen et al., 1999; van Dam et al., 1998; Wieneke & Dienst, 1995). Notably, however, even after controlling for these potential confounds, the data suggest that not all cancer patients are equally affected. Rather, there appears to be a subgroup of patients (an estimated 17-35%) that score in the impaired range. This pattern of results suggests that there may be treatment factors (e.g., type of chemotherapy regimen) or individual factors (e.g., education level, history of head trauma, genetic factors) that predispose certain patients to experience more significant cognitive deficits secondary to chemotherapy (Ahles & Saykin, 2001). A growing body of research is seeking to specify and delineate these factors. For example, preliminary research suggests that one potential risk factor for chemotherapy-induced cognitive decline is the presence of the Apolipoprotein E ε4 (APOE ε4) gene (Ahles, Saykin, Noll, Furstenberg, Guerin, Cole, et al., 2003). This gene has also been linked to increased risk for Alzheimer's disease (Richard & Arnouyel, 2001) and traumatic brain injury (Liberman, Steward, & Wesnes, 2002). Future research such as that of Ahles et al. (2003) may be used to match cancer survivors with optimal treatment regimens that minimize the risk of treatment-induced cognitive dysfunction.

Some researchers (Kibiger, Kirsh, Wall, & Passik, 2003; Wefel et al., 2004) suggest that the publicized "chemobrain" (i.e. cancer patients' perception of a change in cognitive functioning following chemotherapy treatment) may be over-diagnosed because

the cognitive deficits could, in fact, be a function of the affective state that the patient is in (e.g. depression or anxiety due to the implications of the illness) which can lead to subjective declines in cognitive functioning. Psychological factors, particularly depression and anxiety, have been shown to impact memory and concentration in a similar manner to changes reported by cancer patients (Lezak, 1995). Similarly, fatigue, whether biologically or psychologically based, can impact cognitive functioning (Cimprich, 1992). Cull, Hay, and Love (1994) found that self-reported problems with memory and concentration were correlated with self-reported measures of depression, anxiety, and fatigue. Research has associated depression and increased fatigue with chemotherapy (Jacobsen et al., 1999; Okuyama et al., 2000); the directionality of this relationship is unclear. As a result, the role of mood as it pertains to cognitive deficits among cancer survivors remains unclear.

Poppelreuter et al. (2004) tested 119 cancer patients (all-type with breast cancer and hematological malignancies being the most common) who had recently completed acute treatment. Participants were were administered the Hospital Anxiety and Depression Scale, a neuropsychological battery, and the Questionnaire for Self-Perceived Deficits in Attention (FEDA; a German self-report measure of cognitive difficulties). Results of the neuropsychological battery corroborated the participants' subjective complaints of cognitive problems. While a significant correlation between affective status and the self-report of cognitive deficits was reported, 61% of patients displayed deficits in at least one area of cognitive functioning that could not be completely accounted for by negative affect. Although cognitive limitations appear to be related to,

and exacerbated by, emotional distress among cancer survivors, the cognitive limitations reported by this population cannot be fully explained by emotional distress alone.

Brain dysfunction caused by brain cancer is manifested by neurologic and cognitive impairment. Treatment, particularly radiation therapy, tends to affect the subcortical white matter, causing impairments in cognitive speed, frontal lobe executive functions (apathy, perseveration, etc.), memory, sustained attention, and motor coordination (Archibald et al., 1994; Grant, Slattery, Gregor, & Whittle, 1994; Hochberg & Slotnick, 1980; Imperato, Paleologos, & Vick, 1990; Lieberman et al., 1982; Salander, Karlsson, Bergenheim, & Henriksson, 1995; Scheibel, Meyers, & Levin, 1996; Taphoorn et al., 1994). Cognitive function can be affected by a number of factors in brain tumor patients, including adjuvant medications, impaired motor or sensory function, and mood disturbance (Meyers & Hess, 2003). Among brain cancer survivors, added cognitive deficits sometimes develop that coincide with the site and rate of the growth of the tumor (neuropathology) itself and that thus vary among individuals (Scheibel et al., 1996). For instance, in a review of the effects of malignant brain tumors on cognition and behavior, Meyers & Boake (1993) cite that tumors of the right parietal lobe tend to produce deficits in facial discrimination, along with problems attending to the left visual field. Additionally, more diffuse tumors growing at a faster rate (such as glioblastoma multiforme) tend to produce greater behavioral and cognitive impairments in addition to creating problems in adjacent and contralateral brain regions.

In summary, adults with cancer experience cognitive deficits associated with the various treatments they receive. Cognitive difficulties vary from patient to patient, but most commonly include problems with executive functioning, memory, and

concentration/attention. Individual factors such as demographics, education level and emotional distress are also related to the degree of cognitive difficulty reported by cancer patients. However, cognitive deficits remain even after controlling for such factors.

Emotional Distress. Many cancer patients experience significant emotional distress despite actual medical improvement (A. M. Nezu, Lombardo, & Nezu, 2004) because of the life threatening nature of the cancer. Mermelstein and Lesko (1992) reported a fourfold increase in the rate of depression among oncology patients as compared with the general population, and Pelletier, Verhoef, Khatri, and Hagen (2002) reported that many cancer patients experience a heightened level of depression as well as anxiety. Savard and Morin (2001) estimated that 50% of all cancer patients have anxiety and/or depressive disorders. According to other research, approximately 16-25% of newly diagnosed cancer patients experience depression or a clinically significant adjustment disorder with depressed mood (Sellick & Crooks, 1999), and approximately 25% of cancer survivors may experience clinical depression (Massie & Holland, 1990). Even in the absence of a diagnosis of clinical depression or anxiety, cancer patients may experience physical and emotional distress as a result of the psychological stressors inherent to a diagnosis of cancer and its treatment (Theobald, 2004).

Among breast cancer patients, the prevalence of depression has been estimated as high as 57% (Badger, Braden, & Mischel, 2001; Morasso et al., 2001), and Arndt et al. (2004) reported that nearly 90% of 314 breast cancer survivors questioned reported feelings of depression, irritability, tension, or worry. Walker et al. (1999) demonstrated that psychological factors such as symptoms of depression and anxiety are independent prognostic factors of survival among breast cancer survivors undergoing chemotherapy,

regardless of size of tumor at diagnosis. Prior to six cycles of primary chemotherapy, women with newly diagnosed breast cancer were assessed using the Hospital Anxiety and Depression Scale (HADS). Stepwise linear regressions were used to estimate the predictive value of age, menopausal status, clinical nodal status, tumor size at diagnosis, estrogen receptor status, mood, and a psychological intervention on clinical and pathological response to chemotherapy. The HADS depression score was found to be a significant independent predictor of pathological response to chemotherapy, and the HADS anxiety score was found to be a significant independent predictor of clinical response to chemotherapy. In a study of quality of life among brain tumor survivors, Pelletier et al. (2002) reported that many brain tumor patients experienced some heightened level of depression as measured by the Beck Depression Inventory-II, with 38% of the sample (n=73) scoring in the clinically depressed range. Although scores reflecting depression, fatigue, emotional distress, and existential problems were interrelated, the presence of depressive symptoms was found to be the single most important independent predictor of quality of life in this cohort of brain tumor patients.

The long-term impact of cancer on emotional distress is also pronounced. Several studies have reported that childhood cancer survivors have ongoing difficulties with anxiety, posttraumatic stress, and depression (Hobbie, Stuber, & Meeske, 2000; Koocher & O'Malley, 1981; Mulhern, Wasserman, & Friedman, 1996; Shanfield, 1980; Zebrack, Zeltzer, & Whitton, 2002). Hobbie et al. (2000) administered questionnaires and psychiatric interviews to 78 young adults who had been treated for childhood cancer, with a mean number of years since completion of treatment of 11.0 (SD = 5.5 years), and found that 20.5% of the patients met American Psychiatric Association Diagnostic and

Statistical Manual criteria for posttraumatic stress disorder (PTSD) at some point since the end of their treatment. In a study of 9535 adult survivors of childhood cancer (including survivors of leukemia, brain tumors, Hodgkin's disease, non-Hodgkin's lymphoma, Wilms' tumor, neuroblastoma, soft-tissue sarcoma, and bone tumors), moderate to severe impairment in general mental health was observed across all diagnostic groups (Hudson et al., 2003). Weitzner, Meyers, Stuebing, and Saleeba (1997) found that breast cancer survivors of more than five years had significantly higher depression and anxiety scores than controls (low risk breast cancer screening patients). While most of these scores were not indicative of clinical levels of depression, 29% of these survivors scored in the mild to moderate range for depression.

Demographics Associated With Cancer Mortality and Survivorship

It is important to note that prevalence rates vary throughout the U.S. population for different types of cancer. However, epidemiological research has identified several general trends in incidence rates and mortality by gender and ethnicity for the most commonly diagnosed cancers.

ACS has identified racial and socioeconomic disparities in access to breast cancer detection and treatment as critical areas for intervention (Shinagawa, 2000). Overall, cancer incidence and mortality rates are highest among African American men, followed by Caucasian, Hispanic and Asian/Pacific Islander males. In women, Caucasians have the highest incidence rates, followed by African Americans, Hispanics, and Asian/Pacific Islanders. In contrast, African American women have the highest cancer mortality rates, followed by Caucasians and Asian/Pacific Islanders. More advanced stage of disease at diagnosis has been documented among ethnic minority (African American and Latina)

and low-income women (Bentley, Delfino, Taylor, Howe, & Anton-Culver, 1998; Boyer-Chammard, Taylor, & Anton-Culver, 1999). Only 74% of African American women diagnosed with breast cancer survive for five years, compared with 88% of Caucasian women (American Cancer Society, 2004). In addition to increased risk for mortality, more advanced disease may account for an increased number of ethnic minority women who receive mastectomies or adjuvant therapies such as chemotherapy or radiation (Eversley et al., 2005). More advanced disease and more radical treatment may lead to an increased risk for treatment-induced symptoms. African Americans (both male and female) are at a greater risk of dying from the four most common types of cancer (i.e., breast, prostate, colon, and lung) than any other minority group (Aziz & Rowland, 2002). In addition to more advanced disease (and more radical treatment), many of the identified disparities in cancer detection, treatment, and mortality may be attributable to socioeconomic status, healthcare availability and usage, and cultural factors, such as culturally-based reliance on religious coping in the face of a cancer diagnosis (Aziz & Rowland, 2002).

Whereas some cancers are evenly distributed between genders, others are gender specific. Separating incidence rates by gender reveals greater incidence rates of prostate cancer among American males (i.e., 161.2 out of every 100,000 males) and greater incidence rates of breast cancer among American females (i.e., 49 out of every 100,000 females; U. S. Cancer Statistics Working Group, 2004).

Roughly half of adult cancer survivors are less than 65 years of age (Hewitt, Rowland, & Yancik, 2003). Among those less than 65 years of age, cancer survivors aged 35 years or older are more likely to report adverse outcomes in general health,

functional status, activity status, and pain as a result of the cancer or its treatment, compared with survivors aged 18 to 24 years (Hudson et al., 2003). Among breast cancer survivors, Arndt and colleagues (2004) noted that older females tend to report more pronounced difficulties in emotional, social, role, and cognitive functioning (physical functioning was not shown to be a significant problem) than younger females.

Depression at breast cancer diagnosis has been associated not only with younger age (Compas et al., 1999) but also with late-stage diagnoses (Desai, Bruce, & Kasl, 1999). Women who have a history of trauma are at especially high risk for becoming more severely depressed after breast cancer diagnosis (Green et al., 2000). Latinas report significantly higher rates of depression and fatigue, with almost twice the rate of depressive symptoms as African Americans and Caucasians (Eversley et al., 2005). Sociodemographic factors associated with adverse outcomes across all health domains include being female, lower levels of educational attainment, and household income less than $20,000. Mental health problems also have been observed more frequently in the general population with these same sociodemographic features (Hudson et al., 2003).

African American and Latina survivors of breast cancer report significantly higher rates of pain and lymphedema (Eversley et al., 2005). Reasons for increased rates of pain among African Americans and Latinas may include more radical treatments (especially increased rates of mastectomy) as a consequence of being diagnosed with more advanced disease and possible disparities in treatment options (Eversley et al., 2005). Additionally, research suggests that ethnic and racial differences exist in the perception of pain, with African American chronic pain patients demonstrating a lower pain tolerance than Caucasian chronic pain patients (Edwards, Doleys, Fillingim, & Lowery, 2001), and

Latino and African-American patients reporting greater post-operative pain than their Caucasian counterparts (Faucett, Gordon, & Levine, 1994). Reporting lower income, having a mastectomy, having chemotherapy, and being Latina are significant predictors of reporting an increased number of symptoms, suggesting that social and economic factors play a major role in women being able to access post-treatment rehabilitative care (Eversley et al., 2005).

Social Problem Solving

Lazarus and Folkman's stress appraisal and coping theory (1984) suggests that an individual's coping skills are critically important to his or her successful adaptation to stress. Problem-solving abilities are one aspect of coping that can be used to facilitate adaptation to stress (D'Zurilla & Goldfried, 1971; A. M. Nezu, 1989). Problem solving involves the use of a structured approach to deal with the challenges that are associated with, and exacerbating, a stressful situation (Cameron, Shin, William, & Steward, 2004). *Social* problem solving has been defined by D'Zurilla and Nezu (D'Zurilla, 1986; D'Zurilla & Nezu, 1982) as "the self-directed cognitive-behavioral process by which a person attempts to identify or discover effective or adaptive ways of coping with problematic situations encountered in the course of everyday living". In other words, social problem solving is the process that people use to deal with problems that they experience in day to day life.

Good or effective problem solvers are likely to function better when faced with difficult situations than ineffective problem solvers, and thus experience less psychological distress. Social problem-solving has been researched extensively as a mechanism for managing stress (D'Zurilla, 1990; D'Zurilla & Chang, 1995; Nezu,

1986a; Nezu, Nezu, Saraydarian, Kalmar, & Ronan, 1986). In 1971, D'Zurilla and Goldfried initiated research geared towards delineating the role of social problem solving in adjustment, and in the process of this research demonstrated the efficacy of social problem-solving training as a clinical intervention method. This effort resulted in a series of research papers on these topics (e.g., D'Zurilla, 1986; D'Zurilla & Nezu, 1982; Heppner, 1988, 1990; Nezu, 1987; Nezu & D'Zurilla, 1989; Nezu, Nezu, D'Zurilla, & Rothenberg, 1996; Nezu, & Perri, 1989; Spivack, Platt, & Shure, 1976; Tisdelle & St. Lawrence, 1986).

According to the model of problem solving that was introduced by D'Zurilla and Goldfried (1971) and later expanded and refined by D'Zurilla and Nezu (D'Zurilla, 1986; D'Zurilla & Nezu, 1982; Nezu & D'Zurilla, 1989), problem-solving coping is comprised of two partially overlapping elements: 1) problem orientation; and 2) problem-solving proper. Problem orientation is basically a motivational element activated by, and built upon, a set of enduring cognitive-emotional schemas (both adaptive and maladaptive) that reflect an individuals thoughts and feelings towards problems that he or she faces, and towards his or her ability to solve problems (e.g., generalized appraisals, beliefs, expectancies, emotional responses). Along with the approach-avoidance behaviors that accompany them, these schemas are assumed to either enhance or detract from problem-solving performance in specific situations. There are two types of problem solving orientations. *Positive problem orientation* is adaptive, and involves the general disposition to a) appraise a problem as a challenge (an opportunity for benefit or gain) rather than a threat, b) believe that problems are solvable (optimism), c) believe in one's own personal ability to solve problems successfully ("self-efficacy"), d) believe that

successful problem solving takes time, effort, and persistence, and e) commit oneself to solving problems with dispatch rather than avoiding them. In contrast, *Negative Problem Orientation* is maladaptive, and involves the general tendency to a) view a problem as a significant threat to well-being, b) expect problems to be unsolvable (pessimism), c) doubt one's own personal ability to solve problems successfully (low self-efficacy), and d) become frustrated and upset when confronted with problems in living (low frustration tolerance).

Problem orientation does *not* encapsulate the specific problem-solving skills that allow a person to optimize his or her problem-solving effectiveness in stressful situations; this is where problem-solving proper comes into play. Problem-solving proper refers to the strategies or techniques that an individual uses as he or she searches for the best solution to a given problem (D'Zurilla, 1986; Nezu, 1987). Problem-solving proper incorporates four major problem-solving skills: 1) problem definition and formulation, 2) generation of alternative solutions, 3) decision making, and 4) solution verification (i.e. monitoring and evaluation of actual solution outcomes). Three problem-solving dimensions are used to categorize the degree to which an individual employs each of these four skills. The first of these, *Rational Problem Solving,* is adaptive and consists of rational, deliberate, systematic, and skillful application of problem-solving strategies (e.g., problem definition and formulation, generation of alternative solutions, etc.). Rational problem solving involves methodically gathering facts and information, identifying demands and obstacles, setting a problem-solving goal, generating a list of alternative solutions, evaluating possible outcomes, comparing/contrasting the alternatives, and ultimately selecting and implementing a solution while simultaneously

monitoring the outcome. The second dimension of problem solving, referred to as the *Impulsivity/Carelessness Style,* is maladaptive and involves active attempts to implement problem-solving strategies. However, these attempts are narrowed, impulsive, careless, hurried, and incomplete. Impulsive/careless problem solving is characterized by consideration of only a few solution alternatives, impulsively implementing the first idea that comes to mind; evaluating alternatives and consequences quickly, carelessly, and unsystematically, and monitoring solution outcomes carelessly. Finally, the *Avoidance Style* is another maladaptive problem-solving pattern characterized by procrastination, passivity or inaction, and dependency. Avoidant problem solving is characterized by attempting to avoid problems rather than confront them, putting off solving problems for as long as possible, waiting for problems to resolve themselves, and attempting to shift the responsibility for solving ones problems onto others (D'Zurilla, Nezu, & Maydeu-Olivares, 2002).

Problem solving and emotional distress

Studies have consistently found a significant relationship between problem-solving deficits and psychological distress, such as depressive symptomatology (Nezu, 1985, 1986a, 1987) and anxiety (Nezu, 1985, 1986b; Nezu & Carnevale, 1987). Problem-solving skills have been found to be significant mediators of the deleterious effects of stressful life events (Kant, D'Zurilla, & Maydeu-Olivares, 2004; Nezu, 1986b; Nezu, Nezu, Saraydian, Kalman, & Ronan,1986; Nezu & Ronan, 1985). For example, effective problem solvers under high levels of stress have been consistently found to report lower levels of depressive symptoms as compared to ineffective problem solvers under similar levels of high stress (Nezu & D'Zurilla, 1989).

Clinical Interventions Centered on Problem Solving

Problem solving therapy (PST) is a clinical intervention aimed at increasing an individual's ability to cope with stressful problems (Nezu, Nezu, Felgoise, McClure, & Houts, 2003). Training individuals to become better or more effective problem solvers has been demonstrated to be an effective clinical intervention. Previous research has identified PST to be an efficacious clinical intervention for a variety of psychological disorders (D'Zurilla & Nezu, 1999). One group of studies has shown that problem-solving therapy is an especially effective treatment approach for clinically depressed individuals (Arean et al., 1993; Hussian & Lawrence, 1981; Nezu, 1986b; Nezu & Perri, 1989). Interventions directed at training problem-solving skills have been associated with reductions in both depression and anxiety (Nezu, 1986a, b; Nezu & Ronan, 1988; D'Zurilla & Sheedy, 1991; Elliott, Sherwin, Harkins, & Marmarosh, 1995). In fact, problem-solving therapy has been found to be as effective as antidepressant drugs (i.e., amitriptyline) in reducing depressive symptoms (Mynors-Wallis, Gath, Lloyd-Thomas, Tomlinson, 1995).

To facilitate extension of problem solving therapy into the realm of cancer, the experience of cancer is conceptualized both as a major negative life event and as the cause of a series of stressful daily problems and hassles (Nezu, Nezu, Houts, Friedman, & Faddis, 1999; A. M. Nezu & D'Zurilla, 1989). Both sources of stress are expected to increase the likelihood that a cancer patient will experience significant psychological distress. The cancer patient's problem-solving ability is conceptualized as an important moderator of these relationships, whereby effective problem-solving ability should diminish the probability that the cancer patient will experience distress (Nezu, Nezu,

Felgoise, et al., 2003). This conceptualization has been supported by research findings from adult cancer patients (Nezu, Nezu, Faddis, DelliCarpini, & Houts, 1995; Nezu, Nezu, Frieman, et al., 1999). Nezu, Nezu, Faddis et al. (1995) found that under comparably elevated levels of cancer-related stress, those patients who were characterized as ineffective problem solvers endorsed greater levels of depression than cancer patients who were categorized as effective problem solvers. PST was also found to significantly affect clinician-rated symptoms of depression of cancer patients (Nezu, Nezu, Felgoise, et al., 2003). PST appears to be an effective psychosocial intervention for the treatment of significant psychological distress among adult cancer patients; providing PST to patients with cancer enhances their ability to cope more effectively and, as a result, positively impacts their quality of life (Nezu, Nezu, Felgoise, et al., 2003).

Proposed Model

To tie the previously reviewed literature together, the following model is proposed:

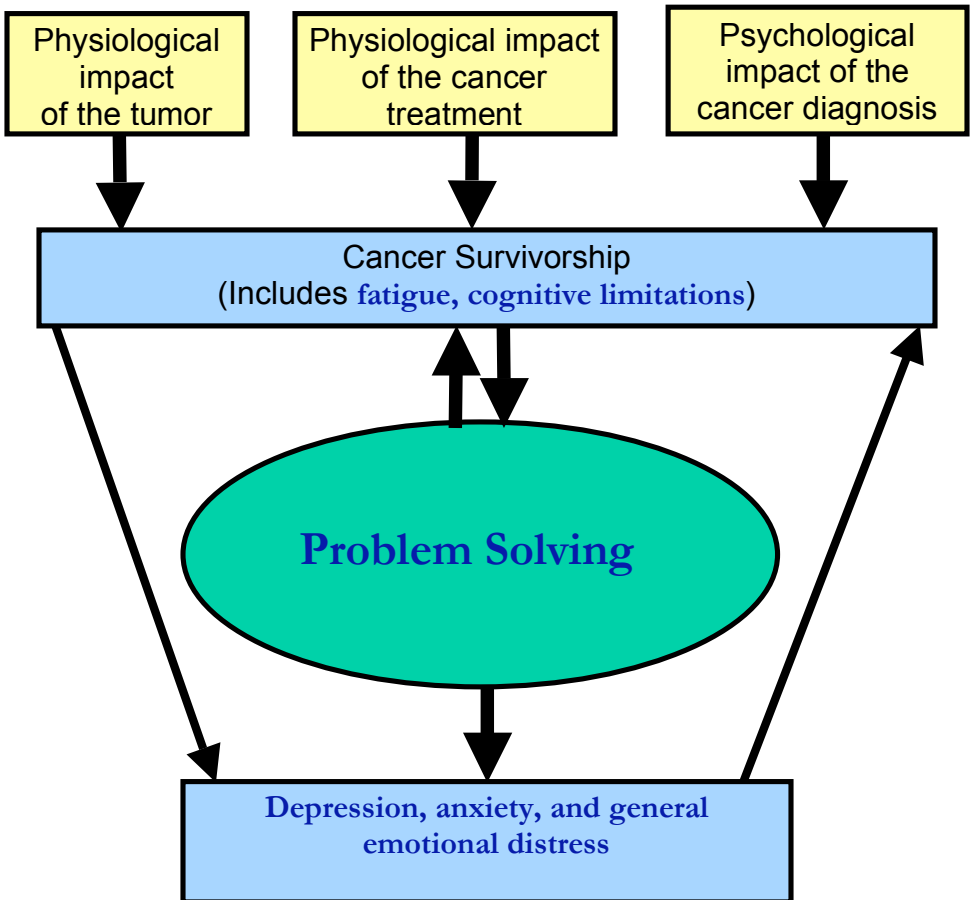


Figure 2. **Proposed model depicting the relationship between cancer survivorship, problem solving, and emotional distress**

Three primary quantifiable inputs to the experience of cancer survivorship include the physiological impact (pathology) of the tumor itself, the physiological impact of the cancer treatment (including surgery, chemotherapy, radiation, and supplemental medications), and the psychological impact of the cancer diagnosis and the associated treatment. Problem solving is proposed to moderate the relationship between cancer survivorship and the emotional distress that is commonly experienced by cancer survivors. Specifically, constructive problem solving orientations/approaches are proposed to reduce the emotional distress experienced by cancer survivors. Symptoms commonly reported by cancer survivors (including cognitive limitations, fatigue, and emotional distress) are also recognized as factors that may impact an individual's ability and/or motivation to use effective problem solving skills, as are the pathology of the tumor itself, and the impact of treatment. However, it is proposed that, even after accounting for these factors, problem solving orientation/approach significantly moderates the relationship between cancer survivorship and emotional distress. In the case of brain cancer, it is proposed that loadings on the three inputs to cancer survivorship are greater than that of breast cancer, due to direct pathological impact on the brain of the cancer and treatment(s), as well as to increased stress of the diagnosis due to poorer prognosis. In accordance with this, it is proposed that survivors of brain cancer will endorse greater emotional distress than survivors of breast cancer.

Study Rationale/Purpose

There has been a dramatic increase in the number of individuals having survived cancer (U.S. Cancer Statistics Working Group, 2004). A growing body of research has illuminated the long-term effects of a cancer diagnosis and its associated treatments. Regardless of the type of cancer, cancer has a substantial impact on health status, mental health, and overall quality of life (e.g., Bodurka-Bevers et al., 2000). Specific symptoms associated with cancer survivorship include but are not limited to cognitive deficits, fatigue, depression, and anxiety. In parallel with the growing survival rates among those diagnosed with cancer, researchers have placed an increasing emphasis on optimizing long-term function of cancer survivors. Of particular interest are modifiable behavioral concomitants of cancer survivorship, such as emotional distress, that are commonly reported by cancer survivors and which directly and significantly impact cancer survivors' quality of life. These symptoms should be increasingly studied in an effort to shift perspective from potential uncontrollable consequences of illness to a greater emphasis on behaviors that maintain wellness (Hobbie et al., 2000). This effort is of particular importance within the context of brain cancer where, because of brain cancer's poor prognostic status, a beneficial treatment may simply be one that stabilizes or slows the progression of worsening symptoms, whether or not overall survival is extended (Meyers & Hess, 2003).

Problem solving has been found to be a significant mediator of the deleterious effects of stressful life events (e.g., Kant, et al., 2004). Social problem solving has been extensively studied as a stress management strategy (e.g., D'Zurilla & Chang, 1995). Good or effective problem solvers are more likely to function more competently and experience less psychological distress when encountering difficult or stressful problems

as compared to poor or ineffective problem solvers. Problem solving therapy (PST) is a clinical intervention approach aimed at increasing an individual's ability to cope with stressful problems (Nezu, Nezu, Felgoise, et al., 2003). PST appears to be an effective psychosocial intervention for the treatment of significant psychological distress among adult cancer patients (Nezu, Nezu, Felgoise, et al., 2003). However, no prior study has examined the relationship between problem-solving and emotional distress among a sample of brain tumor survivors. Additionally, none of the aforementioned research on problem solving and emotional distress among cancer patients has accounted for common correlates of cancer survivorship such as fatigue and cognitive limitations. It is plausible that the relationship between problem solving and emotional distress among cancer patients may be influenced by a number of factors currently unaccounted for, such as fatigue and cognitive limitations. It is also plausible that the interplay between problem solving, emotional distress, fatigue, and cognitive limitations differs from one subclass of cancer survivors to the next. Given the limited findings with regard to the relationship between cancer survivorship, problem solving orientation, and emotional distress, further investigations are warranted.

At first glance, the choice to compare breast and brain cancer survivors may seem arbitrary. The pathology, mortality, and treatment of brain and breast cancer differ widely. Whereas a large portion of the cancer survivorship literature has focused on breast cancer survivors (Phillips & Bernhard, 2003), many psychological aspects of brain tumor survivorship have not been well studied. Brain cancer is a unique model of cancer survivorship because, due to the location of the tumor, the disease and treatment of brain cancer directly affect the brain, which can in turn directly impact both physiological and

psychological functioning and quality of life. In contrast with breast cancer, many aspects of brain cancer survivorship have not been well studied. The differences between breast and brain cancer facilitate investigation into the impact of the cancer diagnosis, cancer pathology, and treatment on symptoms commonly associated with cancer survivorship. These differences may also relationship between problem solving and emotional distress among brain and breast cancer survivors. Determining the specific role of this modifiable skill can help refine future attempts to use this approach with breast cancer survivors, and can help to guide future attempts to extend this approach into the realm of brain cancer survivors. Such efforts are a necessary prerequisite for development of theoretically and scientifically sound interventions to address the myriad of symptoms associated with cancer survivorship.

The specific aim of this study is to examine, and contrast, the relationship between problem solving orientation and emotional distress among brain and breast cancer survivors, while statistically controlling for demographics, treatment-related factors, physical fatigue and cognitive limitations. Brain and breast cancer survivors will be compared to one another as well as to non-cancer comparison participants on the variables of interest. It is hoped that this study will add to the literature by further clarifying the role of problem solving among survivors of breast cancer, and exploring the role of problem solving in brain tumor survivorship. Ultimately, it is anticipated that information obtained from this research will be used to inform the development and design of interventions that serve to optimize the quality of life of cancer survivors.

Hypotheses

Hypothesis 1

Hypothesis 1A. Problem-solving will be significantly and inversely related to depression, anxiety, and general emotional distress among brain and breast cancer survivors and non-cancer comparison participants, after accounting for relevant demographic factors.

Hypothesis 1B. Problem-solving will be significantly and inversely related to depression, anxiety, and general emotional distress among brain and breast cancer survivors, after accounting for demographic and treatment-related factors.

Hypothesis 1C. Problem-solving will be significantly and inversely related to depression, anxiety, and general emotional distress among brain and breast cancer survivors, after accounting for demographic and treatment-related factors, fatigue, and cognitive limitations.

Note: Hypothesis 1B and 1C will be run separately for brain and breast cancer survivors, in order to identify the factors independently associated with emotional distress within each group.

Hypothesis 2

Hypothesis 2A. Cancer survivors will report significantly heightened depression, anxiety, and general emotional distress as compared to non cancer comparison participants, after accounting for relevant demographic factors.

Hypothesis 2B. Brain tumor survivors will report significantly heightened depression, anxiety, and general emotional distress compared to breast cancer survivors, after accounting for demographic and treatment-related factors.

Hypothesis 3 (Exploratory)

Hypothesis 3A. The relationship between problem solving and depression, anxiety, and general emotional distress will be contrasted between groups (brain vs. breast cancer), accounting for demographic and treatment-related factors, to determine whether problem solving moderates distress in one group more than the other.

Hypothesis 3B. The relationship between problem solving and depression, anxiety, and general emotional distress will be contrasted between groups (brain vs. breast cancer), accounting for demographic and treatment-related factors, fatigue, and cognitive limitations, to determine whether problem solving moderates distress in one group more than the other.

Methods

Procedure

A web-based questionnaire was placed online using Test Pilot. The questionnaire and the data were hosted on a secure site provided by the Uniformed Services University of Health Sciences (USUHS), http:/cim01.usuhs.mil/mps.jhansen/index.tpx. We chose an online questionnaire because of the ease of use for individuals across the country, which allowed us to gather a larger sample. It had been shown in previous studies that individuals would be more likely to answer questions in an honest and candid manner in an online format in which they perceived more anonymity to their responses. Survivors of brain and breast cancer, and healthy controls, were recruited using newspaper ads, locally distributed flyers, and links placed on websites geared towards brain and breast cancer survivors. Completion of an online consent form was required prior to access to the questionnaire. The entire online assessment required approximately 40 to 60 minutes for respondents to complete. The questionnaire responses were entered into an excel

spreadsheet and imported to SPSS version 11.1 for all data analyses. All information was kept confidential; the participant's name and identifying information was not included on the questionnaire and were at all times kept separate from their data. Upon completion of the questionnaire, participants had an option of submitting a name and address to receive a Lance Armstrong "LIVESTRONG" wristband and a check for $15 as financial compensation for their time. The protocol for this project was evaluated and approved by the USUHS IRB.

Case Definitions

All participants were between the ages of 20 and 70 years, male and female and included all ethnicities. Participants were required to have a minimum of a 7th grade English reading level to facilitate completion of the on-line questionnaire. Adult brain tumor survivors were recruited from the American Association of Brain Tumors (AABT), and other brain tumor web sites such as www.braintumor.org,, www.btfc.org, and www.tbts.org. Adult breast cancer patients, who fell into one of the categories for survivorship listed above for stage I-IV disease, were recruited from breast cancer sites such as www.breastcancer.org, www.nationalbreastcancer.org, www.komen.org, and www.breastcancerfund.org. Further, newspaper ads were placed in Washington, Baltimore, New York, and Los Angeles to additionally recruit brain and breast cancer survivors.

The "survivor" participants were defined as an individual with a malignant brain tumor who had completed the initial treatment course for the tumor (i.e. surgery, radiation, chemotherapy), and ideally had a relatively stable tumor (as assessed by their most recent MRI or CAT scans). A cancer survivor was defined as an individual with a

cancer diagnosis who had worked at least one year prior to diagnosis. The requirement of having worked at least one year prior to diagnosis stemmed from our desire to do research (unrelated to that proposed in this document) examining the impact of a cancer diagnosis on occupational disruption and status.

Healthy non-cancer comparison participants were defined as individuals who did not having any life threatening illness or major chronic disease and who had worked full time outside the home for at least one year prior to taking the questionnaire. Non-cancer comparison participants were not demographically matched to cancer survivors; our statistical analyses will include tests for differences between the two groups of cancer survivors and non-cancer comparison participants on various demographics (see section on Data Analytic Strategy). Demographic variables were included in all multivariate analyses to account for their influence on the dependent measure(s) of interest.

Measures

Medical Status. Participants were asked medical status questions such as type of tumor, stage of tumor, treatment received, time since diagnosis, and whether or not the participant was currently using medication for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or other prescription medication that did not fall into the previous categories.

Hospital Anxiety and Depression Scale (HADS). The HADS is a 14-item self-assessment scale for detecting depression and anxiety in a general medical setting (Zigmond & Snaith, 1983). The HADS was specifically designed to assess the emotional component of physical illness. It consists of two subscales, one measuring Anxiety (A-scale) and one measuring Depression (D-scale), which are scored separately.

Psychometric properties of the HADS are acceptable; the validity and reliability of the HADS was reviewed by Clark and Fallowfield (1986) and found to be satisfactory. Moorey et al. (1991) administered the HADS to 568 cancer patients and calculated Cronbach's alpha of .93 for the Anxiety subscale and .90 for the Depression subscale. Test-retest data taken from within a healthy sample indicate significant correlations of .92 for the Depression subscale and .89 for the Anxiety subscale. The construct validity of the HADS as a measure of two factors was confirmed in a factor analysis of the data collected by Moorey et al. (1991). The HADS was included in our questionnaire to detect minor elevations in depression and anxiety, often found in both cancer patients and survivors (Arndt et al., 2004; Pelletier et al., 2002; Weitzner et al., 1997). The study used both the HADS-A and the HADS-D as dependent variables.

Social Problem Solving Inventory (SPSI-R-SF). The SPSI-R is a 52-item self-report instrument that is linked to a five-dimensional model of social problem solving, which in turn, is derived from a factor-analytic study (Maydeu-Olivares & D-Zurilla, 1996) of the original theory-driven Social Problem Solving Inventory (SPSI; D'Zurilla & Nezu, 1990). The SPSI-R measures two constructive or adaptive problem-solving dimensions (positive problem orientation and rational problem solving) and three dysfunctional dimensions (negative problem orientation, impulsivity/carelessness style, and avoidance style).

Psychometrically, the SPSI-R is characterized by strong reliability and validity estimates. Reliability estimates for the SPSI-R have been calculated in four different sample (two samples of college students, middle-aged adults, and elderly adults); Cronbach's alpha (internal consistency) values calculated from these samples range from

.69 to .95. Test-retest reliability estimates for a college student sample and a nursing student sample were .68 and .91, respectively. The structural validity of the SPSI-R has been verified in two independent samples using confirmatory factor analyses.

This study utilizes the SPSI-R-SF (short form), which is a 25-item, condensed version of the SPSI-R. The SPSI-R-SF is characterized by high correlations with the SPSI-R scales, as well as strong reliability coefficients. For the purposes of this study, the SPSI-R-SF was used to determine the relationship between problem solving and emotional distress (as measured by the HADS-A, HADS-D, and SF-12 MCS) in brain and breast cancer survivors as compared to controls. Higher SPSI-R-SF scores indicate more constructive, effective, or facilitative problem solving, whereas lower scores indicate more defective, ineffective, or dysfunctional problem solving.

Measure of General Physical and Mental Health (SF-12). The SF-12 is used as a measure of general health (Ware, Kosinski, & Keller, 1996). This measure has been used in many studies on health and work and is a population-based measure that permits comparisons of scores with other patient and non-patient groups. The Mental Component Summary (MCS) subscale of the SF-12 provides a reliable and valid measure of general mental health. The psychometric properties of the SF-12 MCS subscale are less well-studied than its predecessor, the MCS-36 (the mental component summary subscale of the SF-36). However, the SF-12 MCS has been shown to capture about 90% of the variance in the MCS-36 (Ware et al., 1996), which has been show to be a valid and reliable measure for use in screening psychiatric disorders (Berwick, 1991; Ware & Gandek, 1994). In one study, the MCS-36 was shown to have a sensitivity of 74% and a specificity of 81% in detecting patients diagnosed with depressive disorder (Ware et al.,

1994). Additionally, the MCS-36 has been shown to be responsive in comparisons of patients before and after recovery from depression (Ware, Kosinski, Bayliss, McHorney, Rogers, & Raczek, 1995); change in the severity of depression (Beusterien, Steinwald, & Ware, 1996); as well as drug treatment and interpersonal therapy for depression (Coulehan, Schulberg, Block, Madonia, & Rodriques, 1997).

Multidimensional Fatigue Symptom Inventory-Short Form (MFSI-SF), Physical Fatigue Subscale. The MFSI-SF is a 30 item self-report measure of fatigue comprised of five symptom domains including general fatigue, physical fatigue, emotional fatigue, mental fatigue, and vigor (Stein, Jacobsen, Blanchard, & Thors, 2004). The MFSI-SF has been demonstrated to be a reliable and valid scale that is sensitive to differences in fatigue between cancer patients and controls (Stein, Martin, Hann, & Jacobsen, 1998). Because the content of the general fatigue, emotional fatigue, mental fatigue, and vigor subscales overlaps (potentially) with other measures of interest (HADS-D, HADS-A, and SF-12 MCS), the physical fatigue scale alone was used for the current study. Several studies have examined the psychometric properties of the MFSI-SF subscales. One study estimated the internal consistency of the physical fatigue subscale at 0.87 (Stein, Jacobsen, Blanchard, et al., 2004); another reported reliability of the physical fatigue scale to be .85 (Stein, Martin, et al., 1998). The Physical Fatigue Subscale consists of six items, including "My muscles ache," "My legs feel weak," "My head feels heavy," "My arms feel weak," I ache all over," and My body feels heavy all over."

Cognitive Symptom Checklist (select items)-CSC. The Cognitive Symptom Checklist was developed for use as a simple patient checklist to assist in orienting providers to several types of cognitive problems (O'Hara, Harrell, Bellingrath, & Lisicia,

1993). This measure essentially provides a self-report index of disruption of tasks that require cognitive functions. While the CSC is not a standardized test instrument, our search revealed the absence of a valid alternate self-report cognitive limitations measure. The full CSC assesses five areas where those with neurological disorders (e. g. head injury, aneurysm, tumor, side effects of cancer treatment) have been shown to experience problems. These include attention/concentration, memory, visual processes, language, and executive function. Through a combination of factor analyses (varimax rotation) and setting the criteria for an item in a factor at 0.4 we reduced the measure to 59 items reflecting three subscales (working memory, executive functioning, and attention). This reduced version of the CSC was used to assess cognitive limitations that our participtns experienced in daily life. The Cronbach's alpha for the three subscales of our modified version of the CSC calculated from our sample were .

Data Analytic Strategy

Prior to analyzing the specific Hypotheses, a general review of the data was performed. The data were looked at to ensure that the variables under investigation were normally distributed. Data were be transformed if necessary, and outliers were eliminated where methodologically appropriate. The two groups of cancer survivors were compared to one another, and to controls, on the following demographics: age, gender, ethnicity, education, marital status, and occupation. Additionally, the breast and brain cancer survivors were compared to one another on the following treatment-related factors: years since diagnosis, treatment type, duration of chemotherapy exposure, reported current general health status, and current use of medication for the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties,

anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories. The Wilks' Lambda test statistic was reported for the various hypotheses.

Data Analytic Approach for Hypothesis 1A: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors and Non-Cancer Comparison Participants, After Accounting for Relevant Demographic Factors

It was hypothesized that problem-solving would be significantly and inversely related to general emotional distress among brain and breast cancer survivors and non-cancer comparison participants, after statistically controlling for demographic factors. A hierarchical linear regression on HADS-D, HADS-A, and SF-12 MCS was run including all participants (brain cancer survivors, breast cancer survivors, and non-cancer comparison participants). Age, gender, occupation, marital status, ethnicity, and education were entered as the first block in the regression model, and SPSI-R-SF scores were entered as the second block.

If the preliminary linear regression was found to be significant (if SPSI-R-SF scores were found to be significantly associated with the three dependant variables), hierarchical linear regression analyses were run (separately) on each of the three dependant variables (HADS-D, HADS-A, and SF-12 MCS Scores), following the same model used for the preliminary regression. It was predicted that SPSI-R-SF scores would be significantly and negatively associated with HADS-D and HADS-A scores, and would be significantly and positively associated with SF-12 MCS scores (due to the fact that elevated scores on the SF 12-MCS reflect lower emotional distress), above and beyond the contribution of the demographic variables.

Data Analytic Approach for Hypothesis 1B: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors

It was hypothesized that problem-solving would be significantly and inversely related to emotional distress among both brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors. Two separate hierarchical linear regressions were run on HADS-D, HADS-A, and SF-12 MCS (one including brain tumor survivors and one including breast cancer survivors). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or other prescription medication that did not fall into the previous categories) were entered as the second block in the regression model, and SPSI-R-SF scores were entered as the third block.

If the preliminary linear regressions were found to be significant (if SPSI-R-SF scores were found to be significantly associated with the three dependent variables, after statistically controlling for demographic and treatment-related variables), hierarchical linear regression analyses were run (separately) on each of the three dependant variables, following the same procedure used for the preliminary regressions. It was predicted that SPSI-R-SF scores would be significantly and negatively associated with HADS-D and

HADS-A scores, and would be significantly and positively associated with SF-12 MCS scores (due to the fact that elevated scores on the SF 12-MCS reflect lower emotional distress), above and beyond the contribution of the demographic and treatment-related variables, among both brain and breast cancer survivors.

Data Analytic Approach for Hypothesis 1C: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

It was hypothesized that problem-solving would be significantly and inversely related to emotional distress among brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations. Two separate hierarchical linear regressions were run on HADS-D, HADS-A, and SF-12 MCS scores (one including brain tumor survivors and one including breast cancer survivors). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or other prescription medication that did not fall into the previous categories) were entered as the second block in the regression model, fatigue (MFSI-SF score) and cognitive limitations (CSC score) were entered as the third block, and SPSI-R-SF scores were entered as the fourth block.

If the preliminary linear regressions were found to be significant (if SPSI-R-SF scores were found to be significantly associated with the three dependent variables, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations), hierarchical linear regression analyses were run (separately) on each of the three dependant variables, following the same procedure used for the preliminary regressions. It was predicted that SPSI-R-SF scores would be significantly and negatively associated with HADS-D and HADS-A scores, and would be significantly and positively associated with SF-12 MCS scores, after statistically controlling for demographic variables, treatment related factors, fatigue, and cognitive limitations, among both brain and breast cancer survivors.

Data Analytic Approach for Hypothesis 2A: Comparison of Emotional Distress Among Cancer Survivors (Brain; Breast) and Non-Cancer Comparison Participants, After Accounting for Relevant Demographic Factors

It was hypothesized that cancer survivors would report significantly heightened depression, anxiety, and general distress as compared to non-cancer comparison participants, after accounting for demographic factors. A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores including all participants (brain cancer survivors, breast cancer survivors, and non-cancer comparison participants). Age, gender, occupation, marital status, ethnicity, and education were entered as the first block in the regression model, and Cancer Status (a dichotomized variable representing cancer survivors and controls) was entered as the second block. It was predicted that Cancer Status would be significantly associated with the three dependant variables, with cancer survivors reporting greater depression, anxiety, and general emotional distress (as

measured by HADS-D, HADS-A, and SF-12 MCS scores), compared to non-cancer comparison participants, after statistically controlling for demographic variables.

If the preliminary linear regression was significant, hierarchical linear regression analyses were run (separately) on each of the three dependant variables, following the procedures used for the preliminary regression. It was predicted that Cancer Status would be significantly associated with the three dependant variables, with cancer survivors having significantly higher HADS-D and HADS-A scores, and significantly lower SF-12 MCS scores, compared to non-cancer comparison participants.

Data Analytic Approach for Hypothesis 2B: Comparison of Reported Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors

It was hypothesized that brain tumor survivors would report significantly heightened HADS-D, HADS-A, and SF-12 MCS score compared to breast cancer survivors, after statistically controlling for demographic and treatment-related factors. Once again, a hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including cancer survivors only. Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the

previous categories) were entered as the second block, and Type Cancer (a dichotomized variable representing brain and breast cancer survivors) was entered as the third block in the regression model. It was predicted that Type Cancer would be significantly associated with the three dependant variables, with brain tumor survivors reporting greater depression, anxiety, and general emotional distress (as measured by HADS-D, HADS-A, and SF-12 MCS scores), compared to breast cancer survivors, after statistically controlling for demographic and treatment-related variables.

If the preliminary linear regression was found to be significant, hierarchical linear regression analyses were run for each of the three dependent variables, following the procedure used for the preliminary regression. It was predicted that Cancer Type would be significantly associated with each of the three dependent variables, with brain tumor survivors having significantly higher HADS-D and HADS-A scores, and significantly lower SF 12-MCS scores, compared to breast cancer survivors, after statistically controlling for demographic and treatment-related variables.

It's important to comment on the approach taken to contrast the emotional distress reported by participant groups in Hypotheses 1C, 2A and 2B. An alternate approach to analyzing these data would have been: 1) (Hypothesis 1C) to run regression analyses including both brain and breast cancer survivors, and utilize groupXsymptom interactions to determine the relative strength of associations between the predictor variables and emotional distress, and 2) (Hypothesis 2) to include all three participant groups in one regression model, and contrast the emotional distress reported by the three participant groups accordingly. In regards to Hypothesis 1C, one of the frequent criticisms of cancer survivorship literature is that too few studies have examined the prevalence and

predictors of emotional distress among patients with a single cancer diagnosis (other than breast cancer). The "standard" in the realm of cancer survivorship research has been to throw together many disparate cancer types and examine the overall prevalence of fatigue, emotional distress, and other sequelae of the cancer diagnosis and treatment. Those studies that have reported prevalence rates of emotional distress within individual cancer diagnoses have tended to include such small sample sizes so as to preclude comparison of emotional distress between groups (i.e., Zabora, 2001). Our aim in the current study was to identify specific factors associated with emotional distress among brain and breast cancer survivors (as facilitated by our statistical approach to Hypothesis 1C); to replicate prior findings that have shown that individuals with a history of cancer report elevated levels of distress compared to healthy controls (as facilitated by our statistical approach to Hypothesis 2A); and to specifically contrast the levels of depression, anxiety, and general emotional distress reported by brain and breast cancer survivors (as facilitated by our statistical approach to Hypothesis 2B). It was felt that specifically contrasting brain and breast cancer survivors (individually) with non-cancer comparison participants would do little to add to the cancer survivorship literature. Rather, by using the breast cancer survivorship group as a "comparison" group (given that breast cancer survivorship has been so well-studies) we sought to clarify the experience of brain tumor survivors in regards to emotional distress. In addition, this latter comparison (the statistical approach used for Hypothesis 2B) allowed us to statistically control for the impact of treatment-related factors on reported levels of emotional distress; this would not have been possible with a regression analysis including all three participant groups.

Data Analytic Approach for Hypothesis 3A (Exploratory): Determination of Whether Problem Solving Moderates Emotional Distress More Among Brain or Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors

The relationship between problem solving and emotional distress was contrasted between groups (brain vs. breast cancer), after statistically controlling for demographic and treatment-related factors, to determine whether problem solving was more strongly associated with distress in one group than the other. This analysis was exploratory; there is no previous research to suggest whether the relationship between problem solving and emotional distress should be greater among brain than breast cancer survivors or vice versa.

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores. Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, Cancer Type (brain vs. breast) was entered as the third block, SPSI-R-SF scores were entered as the fourth block, and the interaction term contrasting brain and breast cancer survivors on SPSI-R-SF scores was entered last. If the interaction term contrasting participant groups on SPSI-R-SF scores emerged as a significant predictor of

emotional distress, this would indicate that the relationship between problem solving and emotional distress differed between brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors.

In this event, linear regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and SF-12 MCS Scores), following the same procedure used for the preliminary linear regression. If the interaction term contrasting participant groups on SPSI-R-SF scores emerged as a significant predictor of depression, anxiety, or emotional distress, the regression coefficients from the interaction term were used to plot straight lines relating each dependent variable to SPSI-R-SF scores, with separate lines for the two types of cancer. This facilitated a visual comparison of how problem-solving differentially related to depression, anxiety, and general emotional distress among brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors.

Data Analytic Approach for Hypothesis 3B (Exploratory): Determination of Whether Problem Solving Moderates Emotional Distress More Among Brain or Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

The relationship between problem solving and emotional distress was contrasted between groups (brain vs. breast cancer), after statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations, to determine whether problem solving was more strongly associated with distress in one group than the other. This analysis was exploratory; there is no previous research to suggest whether the

relationship between problem solving and emotional distress should be greater among brain than breast cancer survivors or vice versa.

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores. Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, fatigue (MFSI-SF scores) and cognitive limitations (CSC scores) were entered as the third block, Cancer Type (brain vs. breast) was entered as the fourth block, SPSI-R-SF scores were entered as the fifth block, and the interaction term contrasting brain and breast cancer survivors on SPSI-R-SF scores was entered last.

If the interaction term contrasting participant groups on SPSI-R-SF scores emerged as a significant predictor of emotional distress, this would indicate that the relationship between problem solving and emotional distress differed between brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations. In this event, hierarchical linear regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and SF-12 MCS Scores), following the same procedure used for the preliminary regression. If the interaction term contrasting participant groups on SPSI-R-SF scores

emerged as a significant predictor of depression, anxiety, or emotional distress, the regression coefficients from the interaction term were used to plot straight lines relating each dependent variable to SPSI-R-SF scores, with separate lines for the two types of cancer. This facilitated a visual comparison of how problem-solving differentially related to depression, anxiety, and general emotional distress among brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations.

It is now well-established that there is a greater prevalence of depression and anxiety among adult females compared to their male counterparts (Nolen-Hoeksema, 1990; Weissman, Bruce, Leaf, & Holzer, 1991). In order to more closely examine the role that gender plays in the relationship between problem solving and emotional distress, Hypothesis 3B was re-run contrasting male and female brain tumor survivors (this analysis could not be run on the sample of breast cancer survivors due to the fact that, in accordance with epidemiological surveys, our breast cancer participant group included very few males).

Power Analysis

Sample size calculations were based on effect sizes in the published literature presented in the introduction. Because three domains of dependent variables were examined, the 2-sided alpha level of 0.05 was Bonferroni adjusted and set at 0.05/3 = 0.017, at a power (1-beta) level of 80%. Hierarchical linear regressions were used to examine all three hypotheses, to examine the relationship between SPSI-R-SF (linear) score and each of the three dependent measures (HADS-D, HADS-A, and SF-12 MCS scores). Sixty-seven participants per group were required (at minimum) to enable

regression analyses with up to 16 predictors in the model, to evaluate an increase in R-squared of .10 related to problem solving (SPSI-R-SF) scores, at a power level of 80% and $p = 0.017$. This calculation assumed a 0.30 multiple correlation between covariates in the model and the dependent variables.

Results

Participants included in these analyses ($N = 435$) included 138 brain tumor survivors, 148 breast cancer survivors, and 149 non-cancer comparison participants. The initial study sample had included 150 participants in each group. Four participants (two brain tumor survivors and 2 breast cancer survivors) did not report their gender; these participants were excluded from the analyses. One participant (non-cancer comparison participant) did not report their age and was also excluded from the analyses. Ten of the brain tumor survivors reported that their tumor was classified as a meningioma, which is non-malignant; due to the lesser severity of this diagnosis and (generally) less intrusive treatment approach required, these participants were also excluded from the analysis. The overall mean (of the variable in question) was used as a substitution for the following missing data: one missing SF-12 MCS score; six missing HADS-A scores; and 12 missing HADS-D scores. The variable representing exposure to radiation treatment was dichotomized (as opposed to categorizing levels of radiation), due to the fact that 155 participants indicated that they were "not sure" how much radiation they had undergone. For the sample as a whole, participants (on average) were 44 years old ($SD = 11$ years), female (79%), Caucasian (92%), and married (65%).

Demographic information (broken down by participant group) is displayed in Table 1. Treatment and diagnostic-relevant characteristics (for the two groups of cancer

survivors) are presented in Table 2. Table 3 contains the means and standard deviations of the three dependent measures (HADS-D, HADS-A, and SF-12 MCS scores), the independent measure (SPSI-R-SF scores), as well as MFSI-SF (physical fatigue subscale) and CSC (cognitive limitations) scores for each of the three participant groups. Table 4 displays the Pearson correlations among SPSI-R-SF scores and the three dependent measures (HADS-D, HADS-A, and SF-12 MCS scores), for each of the three participant groups. Results of the three linear regressions (run for Hypothesis 1C), predicting HADS-D, HADS-A, and SF-12 MCS scores from SPSI-R-SF scores for breast cancer survivors, after accounting for demographic and treatment-related factors, fatigue, and cognitive limitations are presented in Tables 5, 6, and 7. Results of the three linear regressions (also run for Hypothesis 1C) predicting HADS-D, HADS-A, and SF-12 MCS scores from SPSI-R-SF scores for brain tumor survivors, after accounting for demographic and treatment-related factors, fatigue, and cognitive limitations, are presented in Tables 8, 9, and 10. Figure 3 depicts the predicted values of HADS-A scores for brain and breast cancer survivors, by problem-solving, with relevant demographic and treatment-related factors held constant at their average values. Figure 4 depicts the predicted values of HADS-A scores for brain and breast cancer survivors by problem-solving, with relevant demographic and treatment-related factors, physical fatigue, and cognitive limitations held constant at their average values.

A description of the brain and breast cancer survivor participant groups; differences between groups; and results, organized by hypotheses, are provided below.

Demographic and treatment-related characteristics of brain tumor survivors

On average, brain tumor survivors included in these analyses (*n* = 138) were 43 (*SD* = 10) years old, female (56%), married (76%), and Caucasian (96%). Brain tumor survivors reported an average of 5.2 (*SD* = 4.3) years since the detection of their brain tumor. Eight percent of brain tumor survivors were diagnosed with a Stage I brain tumor; 40% were diagnosed with a Stage II brain tumor; 26% were diagnosed with a Stage III brain tumor; and 20% were diagnosed with a Stage IV brain tumor. Sixty-three percent of brain tumor survivors underwent chemotherapy, reporting an average of 6.9 months (*SD* = 7.5) of chemotherapy. Seventy-three percent of brain tumor survivors reported exposure to radiation treatment (of any dosage). Thirty-nine percent of brain tumor survivors underwent surgery or biopsy in conjunction with their cancer treatment, with 22% endorsing biopsy, 50% endorsing partial resection, and 41% endorsing total resection (note: these categories are not mutually exclusive; some participants underwent biopsy followed by surgery). Eleven percent of brain tumor survivors reported undergoing "other" treatment (e.g., brain tumor survivors might supplement their cancer treatment regimen with use of Protocel. Protocel is a chemical substance which blocks the cancer cell's production of ATP, ultimately causing the cell to self-destruct and break apart). Eleven percent of brain tumor survivors characterized their health (at the time of participation in the study) as "poor;" 30% characterized their health as "fair;" 42% characterized their health as "good;" 16% characterized their health as "very good;" and 1% characterized their health as "excellent." Thirteen percent of brain tumor survivors endorsed taking medication for cancer-related difficulties; 17% endorsed taking medication for mood management; 4% endorsed taking medication for anemia/fatigue;

41% endorsed taking anti-seizure medication; 4% endorsed taking medication for cognitive difficulties; and 45% endorsed taking "other" prescribed medication.

Demographic and treatment-related characteristics of breast cancer survivors

Breast cancer survivors included in these analyses (n = 148) were 50 (SD = 8.8) years old, female (99%), married (62%), and Caucasian (90%). Breast cancer survivors reported an average of 4.5 (SD = 3.9) years since their diagnosis. Thirty-nine percent of breast cancer survivors were diagnosed with Stage I breast cancer; 44% were diagnosed with Stage II breast cancer; and 16% were diagnosed with Stage III brain cancer. Seventy-eight percent of breast cancer survivors underwent chemotherapy, reporting an average of 4.5 (SD = 4) months of chemotherapy. Sixty-four percent of breast cancer survivors reported exposure to radiation treatment (of any dosage). Ninety-five percent of breast cancer participants underwent surgery of some type, with 53% undergoing biopsy, 57% undergoing lumpectomy, 39% undergoing mastectomy, and 15% undergoing bilateral mastectomy (note: these categories are not mutually exclusive; some participants underwent biopsy, lumpectomy, and mastectomy). Nine percent of breast cancer survivors characterized their current health (at the time they took the on-line survey) as "poor;" 37% characterized their health as "fair;" 45% characterized their health as "good;" 7% characterized their health as "very good;" and 1.4% characterized their health as "excellent." Forty-five percent of breast cancer survivors endorsed taking medication for cancer-related difficulties (Note: on the on-line survey, this question was posed as "Are you currently taking cancer related medications, other than chemotherapy or radiation?"); 25% endorsed taking medication for mood management; 5% endorsed taking medication for anemia/fatigue; 6% endorsed taking anti-seizure medication; 0.7%

endorsed taking medication for cognitive difficulties; and 51% endorsed taking "other" prescribed medication.

Demographic differences between the three participant groups

In accordance with epidemiological data (American Cancer Society, 2006), the brain tumor survivor group included significantly more males than the breast cancer survivor group, $t = 10.473$, $p < .001$, or non-cancer control group, $t = 4.368$, $p < .001$. The non-cancer comparison group also included significantly more males than the breast cancer survivor group, $t = 5.895$, $p < .001$. Breast cancer survivors were significantly older than brain tumor survivors, $t = 6.321$, $p < .001$, or non-cancer comparison participants, $t = 8.873$, $p < .001$. Brain tumor survivors were also significantly older than the non-cancer comparison participants, $t = 2.586$, $p = .010$. Non-cancer comparison participants reported significantly higher educational status than breast cancer survivors, $t = 2.770$, $p = .006$, and brain tumor survivors, $t = 3.018$, $p = .003$. Brain tumor survivors were significantly more likely to be married than non-cancer comparison participants, $t = 3.612$, $p < .001$. Brain tumor survivors were significantly more likely to be Caucasian than non-cancer comparison participants, $t = 2.041$, $p < .042$.

Treatment-related differences between breast and brain cancer survivors

Breast cancer survivors were significantly more likely to endorse exposure to chemotherapy for treatment than brain tumor survivors, $t = 2.887$, $p = .004$; however, brain tumor survivors underwent significantly more months of chemotherapy than breast cancer survivors, $t = 3.574$, $p < .001$. Breast cancer survivors were significantly more likely to undergo surgery or biopsy, $t = 2.077$, $p = .039$, and "other treatment," $t = 4.413$, $p < .001$, than brain tumor survivors. Breast cancer survivors were significantly more

likely to report use of medication for cancer related difficulties than brain tumor survivors, $t = 6.345$, $p < .001$. Alternately, brain tumor survivors were significantly more likely to report use of medication for cognitive difficulties, $t = 2.016$, $p = .045$, and use of anti-seizure medication, $t = 7.606$, $p < .001$, than breast cancer survivors.

Differences between the three groups on dependent measures of interest

Regarding the primary measures of interest (HADS-D, HADS-A, SF-12 MCS, SPSI-R-SF, Cognitive Limitations, and Physical Fatigue), overall, the level of distress and impairment reported by brain and breast cancer survivor participants fell within the normal to mild range, as compared to the general population. On the HADS, scores between 0 and 7 represent a "normal" level of distress, 8-10 = mild, 11-14 = moderate, and 15-21 = severe. On the HADS-D, brain and breast cancer survivors' average scores (4.91 and 5.07, respectively) both fell within the normal range of distress. Brain and breast cancer survivors endorsed slightly higher scores (7.15 and 7.75, averaged, respectively) on the HADS-A, but these scores also fell within the mild range of distress. On the SF-12 MCS, a score of 50 represents the mean (as compared to the general population), with a standard deviation of 10. The brain and breast cancer participants' scores averaged around 60, placing them at one standard deviation above the national average in regards to general emotional distress. On the SF-12 MCS, higher scores reflect lower general emotional distress; therefore, our participants were reported slightly less general emotional distress (on average) than the general U.S. population.

Although brain and breast cancer survivor participants endorsed a relatively low level of distress, there were some notable differences between the three participant groups on the primary measures of interest. Breast cancer survivors endorsed

significantly higher depression, $t = 2.240$, $p = .026$, and anxiety, $t = 2.295$, $p = .022$, than non-cancer comparison participants. Breast cancer survivor participants also reported significantly greater cognitive limitations, $t = 3.395$, $p = .001$, and physical fatigue, $t = 4.509$, $p < .001$, than non-cancer comparison participants. Brain tumor survivors also reported significantly greater cognitive limitations, $t = 3.947$, $p < .001$, and physical fatigue, $t = 2.352$, $p = .019$, than non-cancer comparison participants. The level of depression reported by brain tumor survivors also trended towards significance as greater than that reported by non-cancer comparison participants, $t = 1.860$, $p = .064$. There were no significant differences between breast cancer survivors and brain tumor survivors on the primary measures of interest. However, the level of physical fatigue reported by breast cancer survivors trended towards significance as greater than that reported by brain tumor survivors, $t = -1.812$, $p = .071$. The means and standard deviations of the primary measures of interest (HADS-D, HADS-A, SF-12 MCS, SPSI-R-SF, MFSI-SF (physical fatigue subscale) and CSC (cognitive limitations) scores) are presented in Table 3.

One of the common criticisms of research on emotional distress in cancer survivors is that studies too often report only mean scores and fail to indicate the proportion of participants with clinically significant depression (Trask & Pearman, 2007). The standard "clinical" cutoff for the HADS is a score of 11 (11 or above is taken to indicate a clinically elevated level of anxiety or depression; Trask & Pearman, 2007). Using this criterion, it was determined that 14 of the brain tumor survivor participants, or 10% of the overall sample, fell within the clinically elevated range on the HADS-D, in contrast to 15 (10%) of the breast cancer survivor participants, and 13 (9%) of the non-

cancer comparison participants. On the HADS-A, 23 (17%) of the brain tumor participants reported a clinically elevated level of anxiety, in contrast with 38 (26%) of the breast cancer survivor participants and 25 (17%) of the non-cancer comparison participants. There were no statistically significant differences between participant groups in regards to the proportion of participants who exceeded the threshold for clinically elevated depression and/or anxiety.

Hypothesis 1A: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors and Non-Cancer Comparison Participants, After Accounting for Relevant Demographic Factors

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS including brain tumor survivors, breast cancer survivors, and the non-cancer comparison group. Demographic variables (age, gender, occupation, marital status, ethnicity, and education were entered as the first block in the regression model, and SPSI-R-SF scores were entered as the second block. Data from 435 participants were included in the analysis. As hypothesized, SPSI-R-SF scores were found to be significantly associated with the three dependent variables, $F\,(3, 425) = 45.468$, $p < .001$, $\eta^2 = .243$; participants with higher SPSI-R-SF scores reported less depression, anxiety, and general emotional distress than participants with lower SPSI-R-SF scores, after statistically controlling for demographic variables.

Because the preliminary linear regression was found to be significant, hierarchical linear regression analyses were run (separately) on each of the three dependant variables (HADS-D, HADS-D, and SF-12 MCS scores). SPSI-R-SF (linear) score was found to be significantly associated with HADS-D, after statistically controlling for the demographic

variables listed above, β = -.406, p < .001. Participants with higher SPSI-R-SF scores reported significantly lower depression than participants with lower SPSI-R-SF scores. Gender also trended towards significance as a predictor of HADS-D scores, β = -.085, p = .054; females (n = 342) reported significantly higher depression than males (n = 93).

SPSI-R-SF (linear) score was also found to be significantly associated with HADS-A scores, β = -.467, p = <.001. Participants with higher SPSI-R-SF scores endorsed significantly lower anxiety than individuals reporting relatively lower SPSI-R-SF scores. Gender was also found to be significantly associated with HADS-A scores, β = -.094, p = .029; females (n = 342) reported significantly higher anxiety than males (n = 93).

SPSI-R-SF (linear) score was also found to be significantly associated with SF-12 MCS scores, β = .385, p < .001. Participants with higher SPSI-R-SF scores reported higher SF-12 MCS scores than participants with lower SPSI-R-SF scores (in contrast to the HADS-D and HADS-A, higher SF-12 MCS scores signify *decreased* general emotional distress). Gender trended towards significance as a predictor of SF-12 MCS scores, β = .087, p = .052; females (n = 342) reported significantly greater general emotional distress than males (n = 93). Ethnicity was also significantly associated with SF-12 MCS score, β = -.081, p = .071; participants of non-caucasian ethnicity (n = 36) reported a significantly higher level of general emotional distress than participants of caucasian ethnicity (n = 399).

Hypothesis 1B: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors

Two separate hierarchical linear regressions were run on HADS-D, HADS-A, and SF-12 MCS scores (one including brain tumor survivors (n = 138) and one including breast cancer survivors (n = 148)). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or other prescription medication that did not fall into the previous categories) were entered as the second block in the regression model, and SPSI-R-SF scores were entered as the third block.

Brain tumor survivors. The preliminary linear regression was found to be significant, F (3, 118) = 6.458, $p < .001$, $\eta^2 = .142$; brain tumor survivors participants with higher SPSI-R-SF scores reported less depression, anxiety, and general emotional distress than those with lower SPSI-R-SF scores, after statistically controlling for demographic and treatment-related factors.

Because the preliminary linear regression was found to be significant, individual hierarchical regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and MCS SF-12 scores). SPSI-R-SF (linear) score was found to be significantly associated with HADS-D scores, $\beta = -.093$, $p < .001$, after statistically controlling for demographic and treatment-related variables; brain tumor survivor participants with higher SPSI-R-SF scores reported less depression than those with lower

SPSI-R-SF scores. The use of medication for anemia/fatigue, $\beta = 3.389$, $p = .060$, trended towards significance as a predictor of HADS-D scores; brain tumor survivors who reported use of medication for anemia/fatigue ($n = 5$) endorsed significantly greater depression than those who did not report use of medication for anemia/fatigue ($n = 133$). The use of anti-seizure medication also trended towards significance as a predictor of HADS-D scores, $\beta = 1.166$, $p = .077$; brain tumor survivors who reported use of anti-seizure medication ($n = 56$) endorsed significantly greater depression than those who did not report use of anti-seizure medication ($n = 82$).

SPSI-R-SF (linear) score was also found to be significantly associated with HADS-A scores, $\beta = -.092$, $p < .001$, after statistically controlling for demographic and treatment-related variables; brain tumor survivor participants with higher SPSI-R-SF scores reported less anxiety than those with lower SPSI-R-SF scores. None of the other demographic or treatment-related variables were significantly associated with HADS-A scores among brain tumor survivor participants.

SPSI-R-SF (linear) score was also found to be significantly associated with SF-12 MCS scores, $\beta = .485$, $p < .001$, after statistically controlling for demographic and treatment-related variables; brain tumor survivor participants with higher SPSI-R-SF scores reported less general emotional distress than those with lower SPSI-R-SF scores. Use of medication for mood management was also found to be significantly associated with SF-12 MCS scores, $\beta = -8.860$, $p = .043$; brain tumor survivors who reported use of medication for mood management ($n = 23$) endorsed significantly greater general emotional distress compared to those who did not report use of medication for mood management ($n = 115$).

Breast cancer survivors. The preliminary hierarchical linear regression was found to be significant, F (3, 128) = 20.640, $p < .001$, $\eta^2 = .326$; breast cancer survivor participants with higher SPSI-R-SF scores reported less depression, anxiety, and general emotional distress than participants with lower SPSI-R-SF scores, after statistically controlling for demographic and treatment-related factors.

Because the preliminary linear regression was found to be significant, individual hierarchical regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and MCS SF-12 scores). SPSI-R-SF (linear) score was found to be significantly associated with HADS-D scores, $\beta = -.145$, $p < .001$, after statistically controlling for demographic and treatment-related variables; breast cancer survivor participants with higher SPSI-R-SF scores reported less depression than those with lower SPSI-R-SF scores. Whether or not the participant underwent surgery in conjunction with their cancer treatment was found to be significantly associated with HADS-D scores, $\beta = 2.442$, $p = .037$; breast cancer survivors who had undergone surgery or biopsy ($n = 140$) endorsed significantly greater depression than those who had not undergone surgery or biopsy in conjunction with their breast cancer treatment regimen ($n = 8$). The use of medication for mood management was also found to be significantly associated with HADS-D scores, $\beta = 1.861$, $p = .003$; breast cancer survivors who reported use of medication for mood management ($n = 37$) endorsed significantly greater depression than breast cancer survivors who did not report use of medication for mood management ($n = 111$).

SPSI-R-SF (linear) score was also found to be significantly associated with HADS-A scores, $\beta = -.173$, $p < .001$, after statistically controlling for demographic and

treatment-related variables; breast cancer survivor participants with higher SPSI-R-SF scores reported less anxiety than participants with lower SPSI-R-SF scores. Years since diagnosis trended towards significance as a predictor of HADS-A scores, β = -.170, p = .053; a greater number of years since diagnosis was associated with significantly lower anxiety in contrast with a more recent diagnosis of cancer. The use of medication for mood management was also found to be significantly associated with HADS-A scores, β = 2.566, p < .001; breast cancer survivors who reported use of medication for mood management (n = 37) endorsed significantly greater anxiety than those who did not report use of medication for mood management (n = 111). Whether or not the participant underwent surgery in conjunction with their cancer treatment was found to be significantly associated with HADS-D scores, β = 3.433, p = .010; breast cancer survivors who had undergone surgery (n = 140) endorsed significantly greater anxiety than those who had not undergone surgery in conjunction with their breast cancer treatment regimen (n = 8).

SPSI-R-SF (linear) score was also found to be significantly associated with SF-12 MCS scores, β = .533, p < .001, after statistically controlling for demographic and treatment-related variables; breast cancer survivor participants with higher SPSI-R-SF scores reported less general emotional distress than participants with lower SPSI-R-SF scores. Use of medication for mood management was found to be significantly associated with SF-12 MCS scores, β = -7.152, p = .033; breast cancer survivors who reported use of medication for mood management (n = 37) endorsed significantly greater general emotional distress compared to those who did not report use of medication for mood management (n = 111). Whether or not the participant underwent surgery in

conjunction with their cancer treatment was found to be significantly associated with SF-12 MCS scores, β = -14.960, p = .017; breast cancer survivors who had undergone surgery (n = 140) endorsed significantly greater general emotional distress than those who had not undergone surgery in conjunction with their breast cancer treatment regimen (n = 8). Finally, marital status was found to be significantly associated with SF-12 MCS scores, β = -3.483, p = .009; breast cancer survivors who were married (n = 92) endorsed significantly lower general emotional distress than those who were not married (those who were single or divorced; n = 56)).

Hypothesis 1C: Relationship Between Problem-Solving and Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Two separate hierarchical linear regressions were run on HADS-D, HADS-A, and SF-12 MCS scores (one including brain tumor survivors (n = 138) and one including breast cancer survivors (n = 148)). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or other prescription medication that did not fall into the previous categories) were entered as the second block in the regression model, fatigue (MFSI-SF Physical

Fatigue score) and cognitive limitations (CSC score) were entered as the third block, and SPSI-R-SF scores were entered as the fourth block.

Brain Tumor Survivors. The preliminary hierarchical linear regression was significant, F (3, 116) = 2.752, p = .046, η^2 = .066; breast tumor survivor participants with higher SPSI-R-SF scores reported less depression, anxiety, and general emotional distress than those with lower SPSI-R-SF scores, after statistically controlling for demographics, treatment-related factors, fatigue, and cognitive limitations.

Because the preliminary linear regression was found to be significant, individual hierarchical regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and MCS SF-12 scores). SPSI-R-SF (linear) score was found to be significantly associated with HADS-D scores, β = -.047, p = .043, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations; brain tumor survivor participants with higher SPSI-R-SF scores reported less depression than those with lower SPSI-R-SF scores. Cognitive limitations were found to be significantly associated with HADS-D scores, β = .038, p = .018; brain tumor survivors who endorsed relatively more cognitive limitations endorsed significantly greater depression than those who endorsed relatively fewer cognitive limitations. Physical fatigue was found to be significantly associated with HADS-D scores, β = .332, p < .001; brain tumor survivors who endorsed greater physical fatigue endorsed significantly greater depression than those who endorsed relatively less physical fatigue. Years since diagnosis trended towards significance as a predictor of HADS-D scores, β = -.118, p = .056; greater length of time since cancer diagnosis was associated with less depression than a more recent cancer diagnosis. Whether or not the brain tumor survivor

participant underwent radiation also trended towards significance as a predictor of HADS-D scores, $\beta = 1.104$, $p = .067$; having undergone radiation treatment ($n = 100$) was associated with greater depression than not having undergone radiation treatment ($n = 38$).

SPSI-R-SF (linear) score was also found to be significantly associated with HADS-A scores, $\beta = -.063$, $p = .020$, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations; brain tumor survivor participants with higher SPSI-R-SF scores reported less anxiety than those with lower SPSI-R-SF scores. Physical fatigue was found to be significantly associated with HADS-A scores, $\beta = .255$, $p < .001$; brain tumor survivors who endorsed greater physical fatigue endorsed significantly greater anxiety than those who endorsed relatively less physical fatigue. Finally, use of anti-seizure medication was found to be significantly associated with HADS-A scores, $\beta = -1.495$, $p = .027$; brain tumor survivors who reported use of anti-seizure medication ($n = 56$) endorsed significantly greater anxiety compared to those who did not report use of anti-seizure medication ($n = 82$).

SPSI-R-SF (linear) score was also found to be significantly associated with SF-12 MCS scores, $\beta = .315$, $p = .013$, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations; brain tumor survivor participants with higher SPSI-R-SF scores reported less general emotional distress than those with lower SPSI-R-SF scores. Use of medication for mood management was also found to be significantly associated with SF-12 MCS scores, $\beta = -8.236$, $p = .040$; brain tumor survivors who reported use of medication for mood management ($n = 23$) endorsed significantly greater general emotional distress compared to those who did not report use

of medication for mood management (n = 115). Physical fatigue was found to be significantly associated with SF-12 MCS scores, β = -1.396, p < .001; brain tumor survivors who endorsed greater physical fatigue endorsed significantly greater general emotional distress than those who endorsed relatively less physical fatigue. Whether or not the participant underwent surgery or biopsy in conjunction with their cancer treatment trended towards significance as a predictor of SF-12 MCS scores, β = 7.749, p = .089; brain tumor survivors who had undergone surgery or biopsy (n = 121) endorsed significantly less general emotional distress than those who had not undergone surgery or biopsy in conjunction with their cancer treatment regimen (n = 17). Finally, ethnicity trended towards significance as a predictor of SF-12 MCS scores, β = -12.754, p = .084; non-Caucasian participants (n = 6) endorsed significantly greater general emotional distress than Caucasian participants (n = 132).

Results of the three linear regressions that were run for Hypothesis 1C (predicting HADS-D, HADS-A, and SF-12 MCS scores from SPSI-R-SF scores for brain tumor survivors, while statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations) are presented in Tables 8, 9, and 10.

Breast Cancer Survivors. The preliminary hierarchical linear regression was significant, F (3, 126) = 8.355, p < .001, η^2 = .166; breast cancer survivor participants with higher SPSI-R-SF scores reported less depression, anxiety, and general emotional distress than those with lower SPSI-R-SF scores, after statistically controlling for demographics, treatment-related factors, fatigue, and cognitive limitations.

Because the preliminary linear regression was found to be significant, individual hierarchical linear regression analyses were run on each of the three dependant variables

(HADS-D, HADS-A, and MCS SF-12 scores). SPSI-R-SF (linear) score was found to be significantly associated with HADS-D scores, $\beta = -.082$, $p < .001$, after statistically controlling for demographic and treatment-related variables, physical fatigue, and cognitive limitations; breast cancer survivor participants with higher SPSI-R-SF scores reported less depression than those with lower SPSI-R-SF scores. Whether or not the participant underwent surgery or biopsy in conjunction with their cancer treatment was found to be significantly associated with HADS-D scores, $\beta = 2.524$, $p = .016$; breast cancer survivors who had undergone surgery or biopsy ($n = 140$) endorsed significantly greater depression than those who had not undergone surgery in conjunction with their breast cancer treatment regimen ($n = 8$). The use of medication for mood management was also found to be significantly associated with HADS-D scores, $\beta = 1.139$, $p = .047$; breast cancer survivors who reported use of medication for mood management ($n = 37$) endorsed significantly greater depression than those who did not report use of medication for mood management ($n = 111$). Finally, cognitive limitations were found to be significantly associated with HADS-D scores, $\beta = .071$, $p < .001$; breast cancer survivors who endorsed relatively more cognitive limitations endorsed significantly greater depression than those who endorsed relatively fewer cognitive limitations.

SPSI-R-SF (linear) score was also found to be significantly associated with HADS-A scores, $\beta = -.111$, $p < .001$, after statistically controlling for demographic and treatment-related variables, physical fatigue, and cognitive limitations; breast cancer survivor participants with higher SPSI-R-SF scores reported less anxiety than participants with lower SPSI-R-SF scores. The use of medication for mood management was also found to be significantly associated with HADS-A scores, $\beta = 1.747$, $p = .008$; breast

cancer survivors who reported use of medication for mood management (n = 37) endorsed significantly greater anxiety than those who did not report use of medication for mood management (n = 111). Whether or not the participant underwent surgery or biopsy in conjunction with their cancer treatment was found to be significantly associated with HADS-A scores, β = 3.128, p = .009; breast cancer survivors who had undergone surgery or biopsy (n = 140) endorsed significantly greater anxiety than those who had not undergone surgery or biopsy in conjunction with their breast cancer treatment regimen (n = 8). Cognitive limitations were found to be significantly associated with HADS-A scores, β = .042, p = .009; breast cancer survivors who endorsed relatively more cognitive limitations endorsed significantly greater anxiety than those who endorsed relatively fewer cognitive limitations. Finally, physical fatigue was found to be significantly associated with HADS-A scores, β = .280, p < .001; breast cancer survivors who endorsed greater physical fatigue endorsed significantly greater anxiety than those who endorsed relatively less physical fatigue.

SPSI-R-SF (linear) score was also found to be significantly associated with SF-12 MCS scores, β = .269, p = .029, after statistically controlling for demographic and treatment-related variables; breast cancer survivor participants with higher SPSI-R-SF scores reported less general emotional distress than participants with lower SPSI-R-SF scores. Whether or not the participant underwent surgery or biopsy in conjunction with their cancer treatment was found to be significantly associated with SF-12 MCS scores, β = -13.761, p = .017; breast cancer survivors who had undergone surgery or biopsy (n = 140) endorsed significantly greater general emotional distress than those who had not undergone surgery or biopsy in conjunction with their breast cancer treatment regimen (n

= 8). Marital status was found to be significantly associated with SF-12 MCS scores, β = -3.146, p = .010; breast cancer survivors who were married (n = 92) endorsed significantly lower general emotional distress than those who were not married (those who were single or divorced; n = 56)). Cognitive limitations were found to be significantly associated with SF-12 MCS scores, β = -.189, p = .015; breast cancer survivors who endorsed relatively more cognitive limitations endorsed significantly greater general emotional distress than those who endorsed relatively fewer cognitive limitations. Finally, physical fatigue was found to be significantly associated with SF-12 MCS scores, β = -1.142, p = .001; breast cancer survivors who endorsed greater fatigue endorsed significantly greater general emotional distress than those who endorsed relatively less physical fatigue.

Results of the three linear regressions that were run for Hypothesis 1C (predicting HADS-D, HADS-A, and SF-12 MCS scores from SPSI-R-SF scores for breast cancer survivors, while statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations) are presented in Tables 5, 6, and 7.

Hypothesis 2A: Comparison of Reported Emotional Distress Among Cancer Survivors and Non-Cancer Comparison Participants, After Accounting for Relevant Demographic Factors

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including all participants (n = 435). Age, gender, occupation, marital status, ethnicity, and education were entered as the first block in the regression model, and Cancer Status (a dichotomized variable representing cancer survivors and controls) were entered as the second block. As predicted, Cancer Status was significantly associated

with the three dependant variables, F (3, 425) = 2.869, p = .036, η^2 = .020, with cancer survivors reporting greater depression, anxiety, and general emotional distress than non-cancer comparison participants, after statistically controlling for demographic variables.

Because the preliminary linear regression was significant, individual hierarchical linear regression analyses were run on each of the three dependant variables, following the procedure used for the preliminary linear regression. Cancer Status was found to be significantly associated with HADS-D, after statistically controlling for the demographic variables listed above, β = .129, p = .012; cancer survivors participants reported significantly greater depression compared to non-cancer comparison participants. Gender trended towards significance as a predictor of HADS-D, β = -.087, p = .071; female participants (n = 342) endorsed significantly greater depression than male participants (n = 93).

Cancer Status was also found to be significantly associated with HADS-A scores, β = .117, p = .024; participants with cancer reported significantly greater anxiety compared to non-cancer comparison participants. Gender trended towards significance, β = -.096, p = .047; female participants (n = 342) endorsed significantly greater anxiety than male participants (n = 93).

Cancer Status was not significantly associated with SF-12 MCS scores, β = -.059, p = .251. Gender trended towards significance as a predictor of SF-12 MCS scores, β = .090, p = .065; female participants (n = 342) endorsed greater general emotional distress than male participants (n = 93).

Hypothesis 2B: Comparison of Reported Emotional Distress Among Brain and Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including brain tumor survivors (n = 138) and breast cancer survivors (n = 148). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, and Type Cancer was entered as the third block in the regression model. Contrary to the hypothesis, Type Cancer was not significantly associated with the three dependant variables, F (3, 266) = .768, p = .513, η^2 = .009, after statistically controlling for demographic and treatment-related variables. Because the multivariate linear regression was non-significant, follow-up analyses were not performed.

Hypothesis 3A (Exploratory): Determination of Whether Problem Solving Moderates Emotional Distress More Among Brain or Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including brain tumor survivors (n = 138) and breast cancer survivors (n = 148).

Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery or biopsy as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, Cancer Type (brain vs. breast) were entered as the third block, SPSI-R-SF scores were entered as the fourth block, and the interaction term contrasting brain and breast cancer survivors on SPSI-R-SF scores was entered last.

The interaction term contrasting cancer survivor groups on SPSI-R-SF scores trended towards significance as a predictor of emotional distress, F (3, 264) = 2.565, p = .055, η^2 = .028, suggesting that the relationship between problem solving and emotional distress differs between brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors.

Because the multivariate linear regression was significant, hierarchical linear regression analyses were run on each of the three dependant variables (HADS-D, HADS-A, and SF-12 MCS Scores), following the same procedure used for the preliminary linear regression.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores was not found to be significantly associated with HADS-D scores, β = -.414, p = .152, after statistically controlling for demographic and treatment-related variables. Use

of medication for mood regulation was found to be significantly associated with HADS-D scores, $\beta = .188$, $p = .001$; participants reporting use of medication for mood ($n = 60$) endorsed significantly greater depression than participants who did not report use of medication for mood management ($n = 226$). Use of anti-seizure medication was also found to be significantly associated with HADS-D scores, $\beta = .165$, $p = .005$; participants reporting use of anti-seizure medication ($n = 65$) endorsed significantly greater depression than participants who did not report use of anti-seizure medication ($n = 221$). SPSI-R-SF scores were also found to be significantly associated with HADS-D scores, $\beta = -.322$, $p < .001$; participants with higher SPSI-R-SF scores endorsed significantly lower depression than participants with lower SPSI-R-SF scores.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores was found to be significantly associated with HADS-A scores, $\beta = -.603$, $p = .034$, after statistically controlling for demographic and treatment-related variables. This suggests that the relationship between problem solving orientation/style and anxiety differs between brain and breast cancer survivors, after accounting for demographic and treatment-related factors. Predicted values from the model including a Type Cancer x SPSI-R-SF score interaction term, holding all other variables constant at their average values, were used to plot straight lines relating HADS-A scores to SPSI-R-SF scores, with separate lines for the two types of cancer (See Figure 3). A visual examination of Figure 3 reveals that problem solving orientation/style is more strongly associated with anxiety (as measured by the HADS-A) among breast cancer survivors, after accounting for demographic and treatment-related factors, than among brain tumor survivors.

Use of medication for mood regulation was also found to be significantly associated with HADS-A scores, $\beta = .207$, $p < .001$; participants reporting use of medication for mood ($n = 60$) endorsed significantly greater anxiety than participants who did not report use of medication for mood management ($n = 226$). SPSI-R-SF scores were also found to be significantly associated with HADS-A scores, $\beta = -.300$, $p < .001$; participants with higher SPSI-R-SF scores endorsed significantly lower anxiety than participants with lower SPSI-R-SF scores. Finally, cancer type trended towards significance as a predictor of HADS-A scores, $\beta = .555$, $p = .054$; breast cancer survivors endorsed greater anxiety than brain cancer survivors.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores was not found to be significantly associated with SF-12 MCS scores, $\beta = .034$, $p < .912$, after statistically controlling for demographic and treatment-related variables. Use of medication for mood management was found to be significantly associated with SF-12 MCS scores, $\beta = -.183$, $p = .001$; participants reporting use of medication for mood ($n = 60$) endorsed significantly greater general emotional distress than participants who did not report use of medication for mood management ($n = 226$). SPSI-R-SF scores were also found to be significantly associated with SF-12 MCS scores, $\beta = .352$, $p < .001$; participants with higher SPSI-R-SF scores endorsed significantly lower general emotional distress than participants with lower SPSI-R-SF scores.

Hypothesis 3B (Exploratory): Determination of Whether Problem Solving Moderates Emotional Distress More Among Brain or Breast Cancer Survivors, After Accounting for Relevant Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including brain tumor survivors (n = 138) and breast cancer survivors (n = 148). Demographic variables (age, gender, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, fatigue (MFSI-SF physical fatigue subscale scores) and cognitive limitations (CSC scores) were entered as the third block, Cancer Type (brain vs. breast) was entered as the fourth block, SPSI-R-SF scores were entered as the fifth block, and the interaction term contrasting brain and breast cancer survivors on SPSI-R-SF scores was entered last.

The interaction term contrasting cancer survivor groups on SPSI-R-SF scores trended towards significance as a predictor of depression, anxiety, and general emotional distress, F (3, 262) = 2.313, p = .076, η^2 = .026, suggesting that the relationship between problem solving and depression, anxiety, and general emotional distress differs between brain and breast cancer survivors, after statistically controlling for demographic and treatment-related factors, physical fatigue, and cognitive limitations. Because the preliminary linear regression trended towards significance, individual hierarchical linear regression analyses were run on each of the three dependant variables (HADS-D, HADS-

A, and SF-12 MCS Scores), following the same procedure used for the preliminary linear regression.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores was not found to be significantly associated with HADS-D scores, β = -.306, p = .228, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations. Use of medication for mood management was significantly associated with HADS-D scores, β = .113, p = .019; participants who endorsed use of medication for mood (n = 60) endorsed significantly greater depression than participants who did not endorse use of medication for mood (n = 226). SPSI-R-SF scores were found to be significantly associated with HADS-D scores, β = -.151, p = .034; participants with higher SPSI-R-SF scores endorsed significantly lower depression than participants with lower SPSI-R-SF scores. Fatigue (MSFI-SF physical fatigue subscale score) was found to be significantly associated with HADS-D scores, β = .288, p < .001; participants reporting greater levels of fatigue endorsed significantly greater depression than participants who reported less fatigue. Cognitive limitations (CSC scores) were also significantly associated with HADS-D scores, β = .288, p < .001; participants with greater cognitive limitations endorsed significantly greater depression than participants with fewer cognitive limitations.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores trended towards significance as a predictor of HADS-A scores, β = -.490, p = .055, after accounting for demographic and treatment-related variables, fatigue, and cognitive limitations. This suggests that the relationship between problem solving orientation/style and anxiety differs between brain and breast cancer survivors, after statistically

controlling for demographic and treatment-related factors, fatigue, and cognitive limitations. Predicted values from the model including a Type Cancer x SPSI-R-SF score interaction term, holding all other variables constant at their average values, were used to plot straight lines relating HADS-A scores to SPSI-R-SF scores, with separate lines for the two types of cancer (See Figure 4). A visual examination of Figure 4 reveals that problem solving orientation/style is more strongly associated with anxiety (as measured by the HADS-A) among breast cancer survivors, after statistically controlling for demographic and treatment-related factors, fatigue, and cognitive limitations, than among brain tumor survivors.

Use of anti-seizure medication was found to be significantly associated with HADS-A scores, β = -.135, p = .012; participants reporting use of anti-seizure medication (n = 65) endorsed significantly lower anxiety than participants who did not report use of anti-seizure medication (n = 221). Use of medication for mood management was significantly associated with HADS-A scores, β = .149, p = .002; participants who endorsed use of medication for mood (n = 60) endorsed significantly greater anxiety than participants who did not endorse use of medication for mood (n = 226). SPSI-R-SF scores were found to be significantly associated with HADS-A scores, β = -.178, p = .013; participants with higher SPSI-R-SF scores endorsed significantly lower anxiety than participants with lower SPSI-R-SF scores. Fatigue was significantly associated with HADS-A scores, β = .338, p < .001; participants with higher levels of physical fatigue endorsed significantly greater anxiety than participants with lower levels of physical fatigue. Cognitive limitations (CSC scores) were also significantly associated with

HADS-A scores, $\beta = .149$, $p = .015$; participants with greater cognitive limitations endorsed significantly greater anxiety than participants with fewer cognitive limitations.

The interaction term contrasting cancer survivor groups on SPSI-R-SF (linear) scores was not found to be significantly associated with SF-12 MCS scores, $\beta = -.080$, $p = .774$, after statistically controlling for demographic and treatment-related variables, fatigue, and cognitive limitations. Ethnicity was significantly associated with SF-12 MCS scores, $\beta = -.110$, $p = .035$; non-Caucasian participants ($n = 20$) reported significantly greater general emotional distress than Caucasian participants ($n = 266$). Use of medication for mood management was significantly associated with SF-12 MCS scores, $\beta = -.122$, $p = .020$; participants who endorsed use of medication for mood ($n = 60$) endorsed significantly greater general emotional distress than participants who did not endorse use of medication for mood ($n = 226$). Use of medication for cancer-related difficulties was significantly associated with SF-12 MCS scores, $\beta = .115$, $p = .040$; participants endorsing use of medication for cancer-related difficulties ($n = 85$) reported significantly lower general emotional distress than participants who did not endorse use of medication for cancer-related difficulties ($n = 201$). SPSI-R-SF scores were significantly associated with SF-12 MCS scores, $\beta = .224$, $p = .004$; participants with higher SPSI-R-SF scores endorsed lower general emotional distress than participants with lower SPSI-R-SF scores. Fatigue was significantly associated with SF-12 MCS scores, $\beta = -.335$, $p < .001$; participants with higher levels of physical fatigue endorsed significantly greater general emotional distress than participants with lower levels of physical fatigue. Cognitive limitations (CSC scores) were also significantly associated with HADS-A scores, $\beta = -.164$, $p = .014$; participants with greater cognitive limitations

endorsed significantly greater general emotional distress than participants with fewer cognitive limitations.

Re-analysis of Hypothesis 3B, using a subset of female brain and breast cancer survivors. In order to more closely examine the role of gender in the relationship between problem solving and emotional distress, Hypothesis 3B was re-run contrasting male and female brain tumor survivors (this analysis could not be run on breast cancer survivors given the very small number of male participants in the sample).

A hierarchical linear regression was run on HADS-D, HADS-A, and SF-12 MCS scores, including brain tumor survivors (with 77 females and 61 males). Demographic variables (age, occupation, marital status, ethnicity, and education) were entered as the first block in the regression model, treatment-related variables (months of chemotherapy, whether or not the participant underwent radiation treatment, years since the participant was diagnosed with cancer, whether or not they underwent surgery as a result of the cancer diagnosis, and whether or not they were currently using medications for any of the following: cancer-related difficulties, mood-related difficulties, cognitive difficulties, anemia/fatigue, seizures, or "other" prescription medication that did not fall into the previous categories) were entered as the second block, fatigue (MFSI-SF physical fatigue subscale scores) and cognitive limitations (CSC scores) were entered as the third block, gender was entered as the fourth block, SPSI-R-SF scores were entered as the fifth block, and the interaction term contrasting males and female brain tumor survivors on SPSI-R-SF scores was entered last.

The interaction term contrasting male and female brain tumor survivors on SPSI-R-SF was not significantly associated with emotional distress, F (3, 115) = 1.027, p =

.384, $\eta^2 = .026$, suggesting that the relationship between problem solving and emotional distress does not differ significantly between female and male brain tumor survivors, after statistically controlling for demographic and treatment-related factors, physical fatigue, and cognitive limitations. Because the preliminary linear regression was non-significant, individual follow-up hierarchical regression analyses were not performed.

Discussion

Status of Brain and Breast Cancer Survivors, Five Years Post-Diagnosis

Results of the current study suggest that brain and breast cancer survivors continue to endorse a heightened level of distress, up to five years post-diagnosis and well past the acute phase of treatment, compared to individuals without a prior cancer diagnosis. Although the level of depression, anxiety, general emotional distress, fatigue, and cognitive limitations reported by brain and breast cancer survivor participants in this study fell within the normal to mild range as compared to the general population, significant differences emerged between cancer survivors and non-cancer comparison participants. In particular, breast cancer survivors endorsed significantly greater symptoms of depression, anxiety, physical fatigue, and cognitive limitations than non-cancer comparison participants. Brain tumor survivors endorsed higher levels of depression (statistical trend), and significantly greater cognitive limitations and physical fatigue than non-cancer comparison participants. It appears that symptoms of depression, anxiety, general emotional distress, fatigue, and cognitive limitations continue to be experienced among cancer survivors, even if to a mild degree, long past completion of the primary phase of treatment. This is consistent with other studies (e.g., Broeckl, 2000; Hobbie et al., 2000; Koocher & O'Malley, 1981; Mulhern et al., 1996; Shanfield, 1980;

Zebrack et al., 2002) that have found greater levels of emotional distress among cancer survivors, even up to eight years post-diagnosis, than among those with no history of cancer.

Problem Solving as a Moderator of Depression, Anxiety, and Emotional Distress Among Brain and Breast Cancer Survivors

The finding that problem solving was significantly associated with depression, anxiety, and general emotional distress for all participants (cancer survivors and non-cancer comparison participants) after accounting for demographic variables replicates prior research that has consistently found a significant relationship between problem-solving deficits and psychological distress (Nezu, 1985, 1986a, 1987; Nezu & Carnevale, 1987). The finding that, within the two groups of cancer survivor participants (brain and breast), problem solving was significantly associated with symptoms of depression, anxiety, and general emotional distress after accounting for demographic and treatment-related factors replicates (and extends) prior research that has established a significant association between problem-solving coping and cancer-related distress, particularly among survivors of breast cancer (Nezu, Nezu, Faddis, DelliCarpini, & Houts, 1995; Nezu, Nezu, Friedman, et al., 1999). However, this is the first known study to demonstrate a significant relationship between problem-solving and emotional distress among a sample of brain tumor survivors. This is also the first study of problem solving and emotional distress among cancer patients that has accounted for fatigue and cognitive limitations, two common correlates of cancer survivorship.

Fatigue (Portenoy & Itri, 1999) and cognitive limitations (Ahles & Saykin, 2001) have both been reported by cancer patients to be major obstacles to normal functioning

and a good quality of life. Additionally, fatigue and cognitive limitations are both associated with emotional distress among cancer patients (Lezak, 1995; Stone, Richards, A'Hern, & Hardy, 2000). The finding, within both groups of cancer survivor participants (brain and breast), that problem solving was significantly associated with reductions in depression, anxiety, and general emotional distress, after accounting for demographic and treatment-related variables, fatigue, and cognitive limitations suggests that the relationship between problem solving and emotional distress among cancer survivors is stronger than had previously been established. While the cross-sectional nature of this study obscures the direction of the relationship, these findings suggest that problem-solving coping moderates both specific symptoms of depression and anxiety (as measured by the HADS-D and HADS-A) as well as general emotional distress (as measured by the SF-12 MSC) among brain and breast cancer survivors, even after accounting for the fatigue and cognitive difficulties that so many cancer survivors report.

Problem solving was found to be more strongly associated with anxiety among breast cancer survivors, after accounting for demographic and treatment-related factors, physical fatigue, and cognitive limitations, than among brain tumor survivors. As mentioned previously, brain cancer is a unique type of cancer; due to the location of the tumor, the pathology and treatment of brain cancer directly affect the brain. These direct insults to the brain may lead to biological constraints that directly limit or inhibit problem solving capabilities. Brain tumor survivors might benefit from cognitive rehabilitation in conjunction with, or prior to, the use of interventions such as problem solving therapy which rely heavily upon a cancer survivors' cognitive faculties. Ferguson, Riggs, Ahles and Saykin (2007) note that cognitive rehabilitation among cancer survivors with

cognitive dysfunction often includes repetitive practice and drill in cognitive tasks in order to "promote over-learning and facilitate circuitry repair and cortical organization." Perhaps Problem-Solving Therapy could be modified (for individuals who report elevated levels of cognitive impairment) to include this type of cognitive remediation. Ferguson et al. (2007) also note that cognitive rehabilitation often includes compensatory measures, such as the use of relaxation training to reduce cancer survivors' anxiety related to cognitively challenging tasks (which would serve to reduce their likelihood of success with cognitive tasks). This type of training might be an ideal supplement for use prior to administration of PST to individuals who reported elevated cognitive impairment.

It should be noted that, although the moderating effects of problem solving on anxiety were greater among breast cancer survivors than among brain tumor survivors, no differences were found between brain and breast cancer survivors in the relationships between problem solving and depression or problem solving and emotional distress. Although no differences were found between brain and breast cancer survivors in the level of anxiety reported on the HADS-A, perhaps the anxiety reported by brain tumor survivors is less responsive to intervention. A sense of personal control has been associated with a variety of positive outcomes for those who are living with a chronic illness (Thompson & Collins, 1995). Whereas various techniques and tools are available to breast cancer survivors for monitoring the recurrence of their cancer (i.e., breast self-exams), brain tumors cannot be identified except through medical testing and are often diagnosed only once unexplained symptoms appear (such as dizziness and fatigue; American Association for Cancer Research). It is plausible that, among survivors of breast cancer, problem-solving therapy engenders a greater sense of control over one's

diagnosis and its associated symptoms; brain tumor survivors (due to the nature of the diagnosis and its assessment) may be less likely to feel this way.

Comparison of emotional distress between (brain and breast) cancer survivors and non-cancer comparison participants

Brain and breast cancer survivor participants reported higher levels of depressive and anxious symptoms than non-cancer comparison participants, after accounting for demographic variables. This corresponds with prior research demonstrating that cancer survivors report heightened emotional distress compared to the general population (e.g., Mermelstein & Lesko, 1992; Savard & Morin, 2001; Theobald, 2004). It is notable that the association between cancer survivorship status and distress emerged only for HADS-D and HADS-A scores and not for SF-12 MCS scores. In contrast to the HADS-D and HADS-A, which was specifically designed to assess symptoms of depression and anxiety associated with physical illness, the SF-12 MCS was designed to measure general mental health. SF-12 MCS scores are obtained using an algorithm that applies weights to responses to questions such as "How much of the time during the past four weeks did you have a lot of energy?" and "How much does your health limit you in climbing several flights of stairs?" In contrast, items on the HADS-D include "I feel cheerful" and "I still enjoy the things I used to enjoy," and items on the HADS-A include "I get sudden feelings of panic" and "I feel restless as if I have to be on the move." The items of the SF-12 MCS, due to their more general nature, may be more likely to tap into global distress associated with everyday living, above and beyond distress stemming from a cancer diagnosis. If so, the non cancer comparison participants would be more likely to respond similarly to cancer survivors on the SF-12 MCS. While the SF-12 MCS might

be useful as a screening tool in the realm of clinical oncology, it may be too general for use in clinical outcome research.

Comparison of Emotional Distress Between Brain and Breast Cancer Survivors

Type of cancer (brain or breast) was not significantly associated with depression, anxiety, or general emotional distress, after accounting for demographic and treatment-related factors; the brain and breast cancer survivors who participated in this study endorsed similar levels of psychological distress. This was contrary to our hypothesis that brain tumor survivors would report significantly heightened depression, anxiety, and general emotional distress compared to breast cancer survivors. Although the survival statistics associated with brain cancer are much less favorable than those of breast cancer, the experience of breast cancer is associated with greater threats to other areas of functioning, such as challenges to female identity (i.e., as a result of mastectomy; Engel, Kerr, Schlesinger-Raab, Sauer, & Holzel, 2004). Perhaps it is beyond the scope of the current study to quantify, much less compare, the distress associated with these two distinct types of cancer.

Univariate Findings

The consistent association that was found between female gender and heightened anxiety, depression, and general emotional distress is congruent with research literature that has shown that female cancer survivors typically endorse greater levels of emotional distress compared to their male counterparts (Compas et al., 1999). The significant association between minority status and general emotional distress is congruent with prior research demonstrating that ethnic minorities report heightened emotional distress following cancer diagnosis and treatment compared to their Caucasian counterparts

(Eversley et al., 2005). It is important to note, however, that this study did not include a representative sample of ethnic minorities (the entire sample included 399 Caucasian participants and 36 participants who classified themselves as "Other;" among brain and breast cancer survivors, 266 were Caucasian and 20 classified themselves as "Other.") Future research should specifically examine the relationship between problem solving, emotional distress, and other correlates of cancer survivorship among ethnic minorities.

When treatment-related variables were entered into the regression model, a significant relationship between use of medication for mood management and depression, anxiety and general emotional distress emerged among survivors of breast cancer. A similar relationship (after accounting for treatment-related variables) was found between the use of medication for mood management and general emotional distress among brain tumor survivors. In each of these cases, brain and breast cancer survivor participants who reported use of medication for mood management endorsed significantly greater distress compared to participants who did not report use of medication for mood management. When fatigue and cognitive limitations were additionally entered into the regression model, these relationships retained significance (except for that among breast cancer participants between use of medication for mood management and general emotional distress). These findings lend themselves to several plausible conclusions: 1) the dosage of medication was not adequate to address the depressive symptoms that were present or 2) additional intervention is necessary to fully attenuate this depression. Prior research has found that the majority of cancer patients who meet diagnostic criteria for depression have not been prescribed antidepressants or are not receiving adequate dosage (Ashbury, Madlensky, & Raish, Thompson, Whitney, & Hotz, 2003; Sharpe, Allen, & Strong,

2004). It is recommended that future studies examine the impact of alternate dosing strategies and/or adjunctive medications among adult cancer survivors who are several years post-diagnosis and report symptoms of depression or anxiety.

Similar relationships emerged among brain tumor survivor participants between use of anti-seizure medication and depression, and between use of anti-seizure medication and anxiety. Brain tumor survivors who reported use of anti-seizure medication endorsed significantly greater depression (after accounting for demographics and treatment-related variables) and anxiety (after accounting for demographics, treatment-related variables, physical fatigue, and cognitive limitations) compared to participants who did not report use of anti-seizure medication. Similarly, brain tumor survivors who endorsed use of medication for anemia/fatigue endorsed greater depression (statistical trend) compared to those who did not report use of medication for anemia/fatigue. As in the case of mood medication, it appears that either 1) the dosage of anti-seizure and anemia/fatigue medications are inadequate to address the symptoms present or 2) additional intervention is necessary to fully attenuate the seizures and anemia/fatigue reported by brain and breast cancer survivors. The significant relationship that was found between anti-seizure medication and anxiety was particularly surprising, since prior research has generally found that antiepilectic (anti-seizure) drugs have anxiolytic properties (Ettinger, 2006).

Years since diagnosis trended towards significance as a predictor of anxiety among breast cancer survivor participants (after accounting for demographics and treatment related variables), and trended towards significance as a predictor of depression among brain tumor survivors (after accounting for demographics, treatment-related

variables, physical fatigue, and cognitive limitations). A greater number of years since diagnosis was associated with less anxiety and depression than a more recent cancer diagnosis. This coincides with prior literature which has demonstrated a decline in emotional distress over the years since diagnosis (Bloom, 2004; Broeckel, 2000; Schroevers, Ranchor, & Sanderman, 2006). It should be noted that, despite this longitudinal trend in reduction in symptoms, breast cancer survivors endorsed significantly greater anxiety and depression, and brain tumor survivors endorsed greater levels of depression (statistical trend) than non-cancer comparison participants.

Among breast cancer survivors, having undergone surgery in conjunction with cancer treatment was associated with significantly greater depression, anxiety, and general emotional distress, compared to those whose treatment regime had not included surgery (after accounting for demographics, treatment-related variables, physical fatigue, and cognitive limitations). Notably, brain cancer survivors who had undergone surgery in conjunction with their cancer treatment endorsed *less* general emotional distress (trend) than those whose treatment regime had not included surgery. These findings are surprising, given that individuals diagnosed with breast cancer almost unilaterally undergo surgery unless they are determined to: 1) be noncompliant with their medical regime; or 2) have metastatic cancer that is so widespread that surgical techniques are rendered ineffective (personal communication with I. Jatoi, March 30 2007). One might expect, therefore, that breast cancer survivors who did not undergo surgery would report greater levels of emotional distress, given their poorer prognostic status. The current study prohibited inclusion of breast cancer survivors with metastatic cancer; however this does not fully account for these counter-intuitive findings. One possible explanation is

that some third factor (i.e., pain induced by surgery) is mediating the relationship between surgery and heightened levels of emotional distress among breast cancer survivors. In order to examine this, the regression analyses performed for Hypothesis 1C (on breast cancer survivors) were re-run including our measure of cancer-related pain. Pain did not emerge as a significant factor predicting depression, anxiety, or emotional distress, and the relationship between surgery and heightened emotional distress retained significance.

Another plausible explanation for these findings relates to the negative psychosocial sequelae of mastectomy. A majority of the breast cancer survivor participants in this study had undergone either mastectomy (n = 57) or bilateral mastectomy (n = 23). Whereas, among brain tumor survivors, surgery may serve an emotionally protective function (i.e. certainty regarding the tumor diagnosis), among breast cancer survivors who undergo mastectomy, it is also associated with feeling less physically attractive, increased self-consciousness about appearance, and feeling less feminine (Hopwood et al., 2000); as well as increased social isolation and avoidance of activities requiring exposure of the torso (e.g., swimming; Meyer & Aspergren, 1989). In the case of breast cancer survivors, perhaps any relief in emotional distress that may come from surgical removal of the tumor is outweighed by the well-established long-term social and emotional impacts of mastectomy (e.g., Hopwood, Lee, Shenton, Baildam, Brain, Laloo, et al., 2000). Future research is needed to either confirm this paradoxical finding, or to identify mechanisms that can explain the surprising relationship between surgery and increased emotional distress among breast cancer survivors.

Among breast cancer survivors, being married was associated with less general emotional distress than being single or divorced (after accounting for demographics, treatment-related variables, physical fatigue, and cognitive limitations). This coincides with prior literature that has established positive marital status as a protective factor for emotional distress among cancer survivors (Bellizzi & Blank, 2006; Weihs, Enright, Howe, & Simmens, 1999). However, the protective effects of marriage were not evident among brain tumor survivor participants.

Among breast cancer survivors, cognitive limitations were significantly associated with depression, anxiety, and general emotional distress; breast cancer survivor participants who endorsed greater cognitive impairment endorsed greater distress than those who endorsed relatively less cognitive impairment. Among brain tumor survivors, a similar relationship was found between cognitive limitations and depression. This is congruent with past literature showing that cognitive limitations can have a dramatic and negative impact on cancer patients' quality of life (Ahles & Saykin, 2001).

Higher levels of physical fatigue were associated with greater anxiety and general emotional distress among breast cancer survivor participants, and with depression, anxiety and general emotional distress among brain cancer survivor participants. This is congruent with prior research linking fatigue with depression (Stone, Richards, A'Hern, & Hardy, 2000) and poor quality of life (Portenoy & Itri, 1999).

Among brain tumor survivors, having undergone radiation treatment was associated with significantly greater depression than not having undergone radiation treatment. This coincides with prior research that has shown a high prevalence of

depressive symptoms among cancer survivors who have undergone radiation treatment (e.g., Tibbs, 2003).

Limitations

This study is cross-sectional and therefore it was not possible to determine the exact direction of the relationship between problem solving and emotional distress. For example, our finding that problem solving was significantly associated with depression, anxiety, and general emotional distress after accounting for demographic and treatment-related factors, fatigue, and cognitive limitations, could signify either that a) deficits in problem solving result in greater anxiety, depression, and emotional distress or b) greater anxiety, depression, and emotional distress lead to deficits in problem solving.

Another limitation is that the information obtained regarding participants' diagnosis, treatment type, and treatment dosage were not taken directly from the medical record but instead were provided by participant self-report which is subject to recall bias. However, in some cases, patient self-report can allow for greater external validity of research findings (Howard, 1994). Additionally, given the traumatic nature of a cancer diagnosis, most survivors are painfully aware of what their diagnosis is, the type of treatment they have had, and the stage of their tumor. Maunsell et al. (2005) compared the self-report and medical records of 103 breast cancer survivors for agreement on key treatment and prognostic characteristics. A robust level of level of agreement was found between the participants' self-report and their medical records. These findings suggest that summary treatment and prognostic data reported by breast cancer survivors, even several years post diagnosis, are highly valid.

Another limitation of this study is the limited generalizability of our findings to the general population of breast and brain cancer survivors. Participants in this study were five years post-cancer diagnosis (on average), were past the acute phase of treatment, were middle-aged (averaged 44 years old), were female (79%), were Caucasian (92%) and were highly educated (approximately 40% of participants in both cancer survivor groups had completed work towards a graduate degree). As a result, the findings are based on a homogeneous and nonrepresentative population and are limited to cancer survivors who are. Furthermore, the design of our study (collection of data via an online survey) created a potential self-selection bias because only individuals who had access to, and were familiar with, the internet were eligible to participate. Past research has demonstrated that highly distressed patients may be less likely than others to volunteer for this psycho-oncology research (Spiegel, 1996). |If so, the results reported herein may represent a conservative estimate of the relationship between problem solving and emotional distress. However, these results still cannot be extrapolated beyond the type of patient who volunteers for psycho-oncology research (Brown, Levy, Rosberger, & Edgar, 2003).

It is important to comment on the impact of reliance on the internet for data collection. Individuals of greater functional limitation, marked psychological impairment, and lower socioeconomic status are generally less likely to volunteer for participation in a web-based study. As a result, the levels of emotional distress reported herein may be deflated, resulting in an under-representation of the degree of depression, anxiety, and general emotional distress reported by brain and breast cancer survivors. On the other hand, recruitment of participants in a clinical setting (i.e., community mental

health care centers) would have provided an overestimation of distress endorsed by the general population of brain and breast cancer survivors, because it would have necessarily included only those survivors who continued to experience clinical levels of emotional distress after their cancer diagnosis and treatment. The over-arching study (from which this data was pulled and analyzed) was to examine work outcomes among brain and breast cancer survivors. In light of this, our intent was to examine levels of emotional distress, fatigue, and cognitive impairment among brain and breast cancer survivors who had returned to (or approximated) their pre-cancer level of functioning (i.e., in physical and work-related terms).

The fact that our sample was predominantly female (79%) raised concerns that any relationship found between problem solving and emotional distress might be "carried" or "explained" by the women in the study, given the greater prevalence of depression and anxiety among adult females compared to their male counterparts (Nolen-Hoeksema, 1990; Weissman, Bruce, Leaf, & Holzer, 1991). Our finding that the relationship between problem solving and emotional distress did not differ significantly between female and male brain tumor survivors, after accounting for demographic and treatment-related factors, physical fatigue, and cognitive limitations, suggests that this was not the case. This analysis could not be run on breast cancer survivors given the very small number of male participants in the sample. Future research on breast cancer survivors should use more balanced samples of women and men in order to better clarify the relationship between problem solving and emotional distress among male breast cancer survivor participants.

Yet another limitation of the study is that we did not include a general measure of life stress (e.g., the Life Experiences Survey; Sarason, Johnson, & Siegel, 1978). As a result, it's unclear to what degree the emotional distress reported by cancer survivor participants truly stems from their prior diagnosis or is better attributable to current life stressors.

Clinical Implications

This study adds to the literature by further clarifying the role of problem solving among survivors of breast cancer, and exploring the role of problem solving in brain tumor survivorship. Even though this sample was (on average) five years post-diagnosis, significant relationships emerged between problem solving and depression, anxiety, and general emotional distress among brain and breast cancer survivors, even after accounting for demographics, treatment-related variables, fatigue, and cognitive limitations. This suggests that problem-solving is significantly related (directionality unclear) to quality of life of brain and breast cancer survivors up to five years post-diagnosis, whether or not the reported level of depression, anxiety, or emotional distress is clinically elevated. These findings are particularly important in light of the growing shift in emphasis within the field of oncology from mere medical management of cancer to seeking to improve the physical, psychosocial, and economic outcome of individuals who have a history of cancer (Steiner, Cavender, Main, & Bradley, 2004).

There is a growing interest in clinical interventions for cancer survivors. Accordingly, it is important that we continue to develop and refine theoretically and scientifically sound interventions, such as problem solving therapy (PST), to address the myriad of symptoms associated with cancer survivorship. Problem-solving therapy has

been used to effectively alleviate psychological distress among a range of adult cancer patients (predominantly among breast cancer survivors; e.g., Nezu, Nezu, Felgoise, et al., 2003), but has never before been used to treat a cohort of brain tumor survivors. Findings presented herein can be used to refine future attempts to use problem-solving therapy with breast cancer survivors, and can help to guide future attempts to extend this approach into the realm of brain cancer survivors. Our findings that problem solving was more strongly associated with anxiety among breast cancer survivors than among brain tumor survivors suggest that brain tumor survivors might benefit from cognitive rehabilitation in conjunction with, or prior to, use of interventions such as problem solving therapy which rely heavily upon a cancer survivors' cognitive faculties.

The significant differences in depression, anxiety, and general emotional distress that emerged between cancer survivors and non-cancer comparison participants suggest that screening for depression and anxiety could fruitfully be done even up to five years post-cancer diagnosis. Although the level of depression, anxiety, and general emotional distress reported by brain and breast cancer survivor participants in this study fell within the normal to mild range as compared to the general population, 41% of brain tumor survivors and 47% of brain cancer survivors characterized their health as either "fair" or "poor." In addition, cancer survivorship research has consistently found that symptoms of anxiety and depression (even when sub-clinical) are significantly associated with a range of outcomes including quality of life (Iconomou et al., 2004); work limitations (Feuerstein et al., in press); health behaviors/compliance (Andersen, Kiecolt-Glaser, & Glaser, 1994; DiMatteo, Lepper, & Croghan, 2000), and (some studies suggest) clinical and pathological response to treatment (Walker et al., 1999). Our findings suggest that

there are long-term cancer survivors who could benefit from continued psycho-social intervention to help them cope with symptoms of depression, anxiety, and general emotional distress, even when these do not meet clinical thresholds for diagnosis. However, such individuals are not likely to be identified without proactive and targeted screening procedures. Patients are often so preoccupied with the physical components of their cancer that they may be unaware of the severity or impact of their own psychosocial distress, and may not be aware that help is available to treat these symptoms (Carlson et al., 2004). Almost half of cancer patients who knowingly meet distress criteria do not seek professional psychosocial support nor do they have future intent to do so (Carlson, Angen, Cullum, Goodey, Koopmans, Lamont, et al., 2004). It is recommended that physicians working with long-term cancer survivors routinely screen cancer survivors for depression, anxiety, and general emotional distress This type of screening could serve as a basis for referral for therapeutic intervention, such as the enhancement of problem solving skills with problem solving therapy.

Newer lines of research suggest that there may be prognostic advantages to identifying cancer survivors who are depressed and anxious and using targeted interventions to reduce these psychological sequelae (Walker et al., 1999). Depressive symptoms, in particular, have been linked to reduced survival time among cancer survivors, particularly among survivors of breast cancer (Brown, Levy, Rosberger, & Edgar, 2003; Hislop, Waxier, Coldman, Elwood, & Kan, 1987). Several mechanisms have been proposed to explain this relationship, including endocrinological and immunological pathways (Allen-Mersh, Glover, Fordy, Henderson, & Davies, 1998; Cleeland et al., 2003; Luecken & Compas, 2002; McDaniel, Musselman, & Numeroff,

1997; Spiegel, 1996) and medical compliance (Spiegel, 1996). Researchers have proposed that cancer diagnosis and the physical effects of the disease may predispose individuals to distress, which, if maintained over time, in turn exacerbates progression of the disease (Brown et al., 2003). Walker, Heys, Walker, Ogston, Miller, Hutcheon, et al. (1999) found in a study of women with advanced breast cancer that anxiety and depression, as assessed by self-report measure, were significant and independent predictors of the patients' response to chemotherapy in regards to both clinical and pathological outcomes. In addition, Hopwood, Howell, and Maguire (1991) demonstrated that high levels of anxiety and depression are associated with higher mortality rates in cancer patients. Although this line of research is still somewhat controversial, these findings highlight the importance of proactively assessing and treating symptoms of emotional distress among cancer survivors.

Given the relevance of anxiety and depression to clinical outcomes among individuals with a diagnosis of cancer, it is important to have tools that reliably and consistently measure these psychological sequelae. Oncologists and nurses are found to correctly detect mild to moderate depressive symptoms in only one third of patients with depressive symptoms, to underestimate the level of depressive symptoms among patients who are more severely depressed, and to be most influenced by overt symptoms (McDonald, Passik, Dugan, Rosenfeld, Theobald, & Edgerton, 1999; Newell, Sanson-Fisher, Girgis, & Bonaventura, 1998; Passik, Digan, McDonald, Rosenfeld, Thebold, & Edgerton, 1998). Our findings suggest that the HADS is a valid and appropriate measure for assessing symptoms of depression and anxiety among cancer survivors. The HADS was specifically designed to assess the psychological sequelae of medical disorders, and

takes only minutes to complete, so it may be administered in such situations as a hospital waiting room or clinic. Prior studies which have shown that using the HADS to detect symptoms of depression and anxiety in medical populations can save physicians time, and ensure that patients are treated for their mental distress alongside their medical disease (Bambauer, Locke, Aupont, Mullan, & McLaughlin, 2005). The HADS also appears to be a justified target of intervention for clinical outcome research. In contrast, our findings suggest that, while the SF-12 MCS might be useful as a screening tool in the realm of clinical oncology, it may be too generic a measure for use in clinical outcome research.

As mentioned in the introduction to this paper, research is increasingly exploring "symptom clusters" among cancer patients (Dodd, Miaskowski, & Paul, 2001; Kurtz, Given, Kurtz, & Given, 1994; Miaskowski & Lee, 1999). Research on symptom clusters centers on the notion that certain symptoms might share a common etiology or mechanism; that the severity of the symptoms may be correlated with one another; or that the occurrence of the symptom cluster itself may result in different outcomes compared to each of the individual symptoms. Symptom cluster research might have implications for the current study. For example, various degrees of fatigue, emotional distress, and cognitive limitations were reported by the majority of our participants. However, the use of medication for mood management, and the use of medication for anemia/fatigue, were found to be associated with heightened emotional distress. Perhaps targeting these symptoms (fatigue, emotional distress, and cognitive limitations) as a cluster (whether through pharmacologic or non-pharmacologic interventions) would lead to greater attenuation of symptoms, as opposed to targeting each symptom individually.

Future Directions

The findings presented herein warrant replication. However, future research should take the form of longitudinal studies, in order to clarify the direction of the relationship between problem solving and emotional distress. There is also a need for prospective studies with repeated measures over several time points to examine more closely the experience of cancer survivors in regards to emotional distress. These studies could illuminate when during the time course of cancer survivorship individuals are most likely to develop symptoms of depression and anxiety; how long these symptoms endure; whether these symptoms are relatively stable or recur in a cyclical manner; how those with symptoms of depression and anxiety can best be identified, and to what degree treatment of these symptoms prolongs survival or improves the quality of life. In particular, there is a dearth of research on the experience of brain tumor survivorship, largely due to the fact that this is one of the smallest groups of cancer survivors in regards to both incidence and survival rates.

Studies have consistently reported that active coping leads to better adjustment after cancer treatment, whereas avoidant coping is related to worse adjustment (Tibbs, 2003). Problem-solving therapy is clearly an active approach to coping with the stress of cancer survivorship. Future studies should seek to identify factors (such as characterological traits or genetic markers) that predispose individuals to the use of more active coping styles in the face of significant long term stressors such as prolonged symptoms.

Future research should more closely examine the emotional sequelae of an initial as opposed to recurrent diagnosis cancer. Cohen (2002) reported that, among a sample of

breast cancer survivors, those diagnosed with recurrent cancer reported higher levels of depression and anxiety than those with an initial diagnosis of cancer. In addition, breast cancer survivors with recurrent cancer were found to use significantly fewer problem-solving strategies compared to those with an initial diagnosis of cancer.

Future research should specifically examine the relationships between problem solving, emotional distress, and other correlates of cancer survivorship among ethnic minorities. In general, future research in the realm of cancer survivorship would benefit from tighter balancing of groups in terms of demographics, treatment-related factors (including corroboration with data taken directly from medical records), and inclusion of medical markers of stress such as endocrine and immune system factors. Future research in the realm of breast cancer might also seek to more closely examine samples of men in order to better clarify the relationship between problem solving and emotional distress among male breast cancer survivor participants.

Problem solving therapy may not be appropriate for certain subsets of cancer survivors; for example, our findings suggest that, for the treatment of anxiety, brain tumor survivors might benefit from cognitive rehabilitation prior to, or in conjunction with, the use of problem solving therapy. There is a growing emphasis on short-term interventions that can optimize functioning in long-term cancer survivors and that specifically target symptoms commonly associated with cancer survivorship. For example, exercise is the most empirically supported non-pharmacological intervention for the treatment of cancer-related fatigue (Wagner & Cella, 2004); like PST, it is easily implemented and circumvents the stigma associated with traditional approaches to mental health. Future studies should more closely examine what treatment approaches are

effective for what types of patients as a function of type of cancer, and other important patient-relevant psychosocial variables.

In conclusion, this study demonstrated a significant relationship, among survivors of brain and breast cancer, between problem solving and depression, anxiety, and emotional distress. This relationship held true even after accounting for demographic and treatment-related variables, fatigue, and cognitive limitations, suggesting that the relationship between problem solving and emotional distress among cancer survivors is stronger than had previously been established. This is the first known study to demonstrate a significant relationship between problem-solving and emotional distress among a sample of brain tumor survivors. This study also revealed a stronger relationship between problem solving and emotional distress among breast cancer survivors than among brain tumor survivors. This suggests that brain tumor survivors might benefit from cognitive rehabilitation prior to, or in conjunction with, the use of problem-solving therapy. Overall, these findings are clinically interesting and deserve further examination.

Table 1

Demographics For Each Participant Group

Participant Group	Brain (n = 138)	Breast (n = 148)	Controls (n = 149)
Age, *M* (*SD*)*	42.80 (10.12)	49.89 (8.84)	39.55 (11.12)
Gender, No. (%)*			
Male	61 (44%)	1 (1%)	31 (21%)
Female	77 (56%)	147 (99%)	118 (79%)
Ethnicity, No. (%)*			
Caucasian	132 (96%)	134 (91%)	133 (89%)
Other	6 (4%)	14 (9%)	16 (11%)
Marital Status, No. (%)*			
Single	15 (11%)	22 (15%)	35 (24%)
Married	105 (76%)	92 (62%)	85 (57%)
Living Together	5 (4%)	6 (4%)	12 (8%)
Divorced	13 (9%)	28 (19%)	17 (11%)
Employment, No.(%)			
Managerial/Admin Sales/Services	53 (38%)	49 (33%)	47 (32%)
Professional/ Technical	53 (38%)	70 (47%)	71 (48%)
Clerical/Admin Support/Production/ Construction/ Maintenance	16 (12%)	22 (15%)	10 (7%)
Other	16 (12%)	7 (5%)	21 (14%)

Education Level*			
Less than High School/GED	14 (10%)	16 (11%)	7 (5%)
Some College	28 (20%)	21 (14%)	19 (13%)
A.A. or Bachelors	40 (29%)	52 (35%)	39 (26%)
Some Grad School	16 (12%)	15 (10%)	23 (15%)
Compl Grad School	40 (29%)	44 (30%)	61 (41%)

*Groups differ significantly at the 0.05 level (2-tailed)
(See Results section for detailed description of the differences between groups)

Table 2

Treatment and Diagnostic Status of Brain and Breast Cancer Survivor Participants

Participant Group	Brain (n = 138)	Breast (n = 148)
Years since diagnosis, *M* (*SD*)	5.19 (4.34)	4.48 (3.9)
Participants (%) diagnosed at the following stages**:		
Stage I	11 (8%)	58 (39%)
Stage II	55 (40%)	65 (44%)
Stage III	36 (26%)	23 (16%)
Stage IV	28 (20%)	N/A
Missing Data	8 (6%)	2 (1%)
Participants (%) who underwent:		
Chemotherapy*	87 (63%)	116 (78%)
Radiation	100 (73%)	95 (64%)
Surgery or Biopsy*	121 (88%)	140 (95%)
Other Tx*	15 (11%)	47 (32%)
Average months of chemotherapy, *M* (*SD*)*	6.90 (7.54)	4.37 (4.03)
Participants who endorsed taking medication for:		
Cancer-related difficulties*	18 (13%)	67 (45%)
Cognitive difficulties*	6 (4%)	1 (1%)
Mood management	23 (17%)	37 (25%)
Anemia/Fatigue	5 (4%)	8 (5%)
Seizures*	56 (41%)	9 (6%)

"Other"	64 (45%)	76 (51%)
Participants (%) who reported radiation treatment (of any dosage):		
	98 (71%)	95 (64%)
Participants who described their current general health status as:		
Excellent	1 (1%)	2 (1%)
Very Good	22 (16%)	10 (7%)
Good	58 (42%)	67 (45%)
Fair	42 (30%)	55 (37%)
Poor	15 (11%)	14 (10%)

* Groups differ significantly at the 0.05 level (2-tailed)
**Note: Comparison could not be made between groups due to different staging systems (See Results section for detailed description of the differences between groups)

Table 3

Means and Standard Deviations of HADS-D (Depression), HADS-A (Anxiety), SF-12 MCS (General Emotional Distress), SPSI-R-SF (Problem Solving), MFSI-SF (Physical Fatigue Subscale), and CSC (Cognitive Limitations) Scores Across Participant Groups

Group	Brain (n = 138)	Breast (n = 148)	Controls (n = 149)
HADS-D, *M* (*SD*)*	4.91 (3.80)	5.07 (3.87)	4.05 (3.88)
HADS-A, *M* (SD)*	7.15 (3.95)	7.75 (4.61)	6.59 (4.04)
SF-12 MCS, *M* (SD)	61.14 (18.84)	58.28 (18.93)	61.41 (20.44)
SPSI-R-SF, *M* (SD)	68.07 (13.16)	67.47 (12.65)	67.84 (13.07)
Fatigue, *M* (SD)*	4.27 (4.96)	5.30 (4.71)	3.11 (3.70)
Cognitive Lim, *M* (SD)*	31.14 (22.21)	28.76 (21.72)	22.30 (18.57)

* Groups differ significantly at the 0.05 level (2-tailed)
(See Results section for detailed description of the differences between groups)

Table 4

Pearson Correlations Between HADS-D (Depression), HADS-A (Anxiety), and SF-12 MCS (General Emotional Distress) Scores, and SPSI-R-SF(Problem Solving) Scores Across Participant Groups

Group	HADS-D	HADS-A	SF-12 MCS
Brain Cancer Survivors (*n* = 138)			
SPSI-R-SF Score	-.341**	-.383**	.354**
Breast Cancer Survivors (*n* = 148)			
SPSI-R-SF Score	-.546**	-.568**	.439**
Non-Cancer Controls (*n* = 149)			
SPSR-R-SF Score	-.338**	-.434**	.341**

** Correlation significant at the 0.01 level (2-tailed)

Table 5

Linear Regression Using SPSI-R-SF (Problem Solving) Scores to Predict HADS-D (Depression) Scores For Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	B	*p*	95% CI
Block 1: Demographics:	.029	.029			
Gender			-1.822	.521	(-7.426)-(3.781)
Education			.120	.537	(-.180)-(.345)
Race			.580	.488	(-1.070)-(2.230)
Marital Status			.169	.445	(-.268)-(.606)
Job			.259	.377	(-.319)-(.837)
Age			.003	.920	(-.054)-(.059)
Block 2: Treatment-Related Variables:	.257	.228			
Years Since Diagnosis			-.047	.498	(-.184)-(.090)
Cancer-Related Medication			-.213	.675	(-1.214)-(.789)
Meds for Cognitive Difficulties			-3.938	.165	(-9.534)-(1.648)
Mood-Related Medication			1.139	.047	(.016)-(2.262)
Meds for Anemia/Fatigue			-1.237	.265	(-3.424)-(.951)
Anti-Seizure Medication			.727	.470	(-1.256)-(2.709)
Other Prescription Medication			.251	.604	(-.705)-(1.207)
Surgery or Biopsy (Yes/No)			2.542	.016	(.472)-(4.576)
Months of Chemotherapy			.058	.340	(-.062)-(.179)
Radiation Treatment (Yes/No)			-.781	.126	(-1.784)-(.222)
Block 3: Fatigue and Cognitive Limitations:	.518	.261			
Fatigue (MFSI-SF) Score			.073	.228	(-.046)-(.193)
Cognitive Limitations (CSC) Score			.071	.000	(.043)-(.099)
Block 4: SPSI-R-SF Score:	.565	.047			
SPSI-R-SF Score			-.082	.000	(-.126)-(-.038)

Table 6

Linear Regression Using SPSI-R-SF (Problem Solving) Scores to Predict HADS-A (Anxiety) Scores For Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	B	*p*	95% CI
Block 1: Demographics:	.026	.026			
Gender			-.557	.863	(-6.926)-(5.812)
Education			-.006	.977	(-.441)-(.428)
Race			-.063	.947	(-1.939)-(1.813)
Marital Status			.187	.458	(-.310)-(.684)
Job			.419	.210	(-.238)-(1.076)
Age			.019	.566	(-.045)-(.083)
Block 2: Treatment-Related Variables:	.308	.282			
Years Since Diagnosis			-.092	.245	(-.247)-(.064)
Cancer-Related Medication			-.180	.755	(-1.318)-(.958)
Meds for Cognitive Difficulties			-2.410	.454	(-8.760)-(3.940)
Mood-Related Medication			1.747	.008	(.471)-(3.024)
Meds for Anemia/Fatigue			.558	.658	(-1.928)-(3.045)
Anti-Seizure Medication			-.856	.453	(-3.110)-(1.397)
Other Prescription Medication			.038	.946	(-1.049)-(1.124)
Surgery or Biopsy (Yes/No)			3.128	.009	(.795)-(5.460)
Months of Chemotherapy			.018	.800	(-.119)-(.155)
Radiation Treatment (Yes/No)			-.746	.198	(-1.886)-(.394)
Block 3: Fatigue and Cognitive Limitations:	.545	.237			
Fatigue (MFSI-SF) Score			.280	.000	(.144)-(.417)
Cognitive Limitations (CSC) Score			.042	.009	(.011)-(.074)
Block 4: SPSI-R-SF Score:	.604	.060			
SPSI-R-SF Score			-.111	.000	(-.161)-(-.061)

Table 7

Linear Regression Using SPSI-SF-R (Problem Solving) Scores to Predict SF-12 MCS (General Emotional Distress) Scores For Breast Cancer Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	*B*	*p*	95% CI
Block 1: Demographics:	.067	.067			
Gender			16.947	.277	(-13.751)-(47.646)
Education			-1.499	.159	(-3.592)-(.594)
Race			-5.622	.221	(-14.664)-(3.420)
Marital Status			-3.146	.010	(-5.541)-(-.752)
Job			-2.276	.157	(-5.443)-(.891)
Age			.244	.121	(-.065)-(.554)
Block 2: Treatment-Related Variables:	.233	.166			
Years Since Diagnosis			-.092	.808	(-.842)-(.657)
Cancer-Related Medication			5.906	.035	(.421)-(11.392)
Meds for Cognitive Difficulties			14.973	.335	(-15.633)-(45.579)
Mood-Related Medication			-3.677	.239	(-9.830)-(2.477)
Meds for Anemia/Fatigue			-.859	.887	(-12.844)-(11.125)
Anti-Seizure Medication			-5.773	.295	(-16.634)-(5.087)
Other Prescription Medication			4.413	.098	(-.825)-(9.651)
Surgery (Yes/No)			-13.761	.017	(-25.005)-(2.517)
Months of Chemotherapy			.212	.527	(-.449)-(.872)
Radiation Treatment (Yes/No)			1.277	.646	(-4.218)-(6.773)
Block 3: Fatigue/Cognitive Limitations:	.434	.201			
Fatigue (MFSI-SF) Score			-1.142	.001	(-1.799)-(-.485)
Cognitive Limitations (CSC) Score			-.189	.015	(-.342)-(.037)
Block 4: SPSI-R-SF Score:	.455	.021			
SPSI-R-SF Score			.269	.029	(.028)-(.509)

Table 8

Linear Regression Using SPSI-SF-R (Problem Solving) Scores to Predict HADS-D (Depression) Scores For Brain Tumor Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	B	*p*	95% CI
Block 1: Demographics:	.030	.030			
Gender			-.249	.653	(-1.341)-(.843)
Education			.223	.277	(-.182)-(.628)
Race			1.571	.244	(-1.086)-(4.229)
Marital Status			-.049	.864	(-.615)-(.517)
Job			.322	.232	(-.209)-(.852)
Age			.012	.686	(-.046)-(.070)
Block 2: Treatment-Related Variables:	.180	.150			
Years Since Diagnosis			-.118	.056	(-.239)-(.003)
Cancer-Related Medication			-.393	.627	(-1.991)-(1.205)
Meds for Cognitive Difficulties			-.931	.491	(-3.598)-(1.736)
Mood-Related Medication			.770	.292	(-.670)-(.2.209)
Meds for Anemia/Fatigue			1.799	.236	(-1.195)-(4.794)
Anti-Seizure Medication			.460	.427	(-.683)-(1.602)
Other Prescription Medication			.827	.141	(-.277)-(1.931)
Surgery (Yes/No)			-1.123	.178	(-2.766)-(.519)
Months of Chemotherapy			.002	.957	(-.075)-(.079)
Radiation Treatment (Yes/No)			1.104	.067	(-.077)-(2.284)
Block 3 : Fatigue and Cognitive Limitations:	.475	.296			
Fatigue (MFSI-SF) Score			.332	.000	(.213)-(.451)
Cognitive Limitations (CSC) Score			.038	.018	(.007)-(.069)
Block 4: SPSI-R-SF Score:	.493	.018			
SPSI-R-SF Score			-.047	.043	(-.093)-(-.001)

Table 9

Linear Regression Using SPSI-SF-R (Problem Solving) Scores to Predict HADS-A (Anxiety) Scores For Brain Tumor Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	B	*p*	95% CI
Block 1: Demographics:	.085	.085			
Gender			.486	.450	(-.782)-(1.753)
Education			.006	.979	(-.464)-(.476)
Race			2.179	.164	(-.905)-(5.264)
Marital Status			-.531	.112	(-1.187)-(.126)
Job			-.220	.481	(-.835)-(.396)
Age			-.034	.318	(-.102)-(.033)
Block 2: Treatment-Related Variables:	.181	.095			
Years Since Diagnosis			-.002	.975	(-.143)-(.138)
Cancer-Related Medication			-.605	.520	(-2.460)-(1.250)
Meds for Cognitive Difficulties			-.956	.542	(-4.051)-(2.139)
Mood-Related Medication			1.238	.145	(-.433)-(2.909)
Meds for Anemia/Fatigue			1.646	.350	(-1.829)-(5.121)
Anti-Seizure Medication			-1.495	.027	(-2.821)-(-.169)
Other Prescription Medication			.269	.679	(-1.013)-(1.550)
Surgery (Yes/No)			-.918	.342	(-2.825)-(.989)
Months of Chemotherapy			-.076	.096	(-.165)-(.014)
Radiation Treatment (Yes/No)			.301	.664	(-1.069)-(1.671)
Block 3 : Fatigue and Cognitive Limitations:	.338	.157			
Fatigue (MFSI-SF) Score			.255	.000	(.117)-(.393)
Cognitive Limitations (CSC) Score			.020	.270	(-.016)-(.056)
Block 4: SPSI-R-SF Score:	.368	.030			
SPSI-R-SF Score			-.063	.020	(-.116)-(-.010)

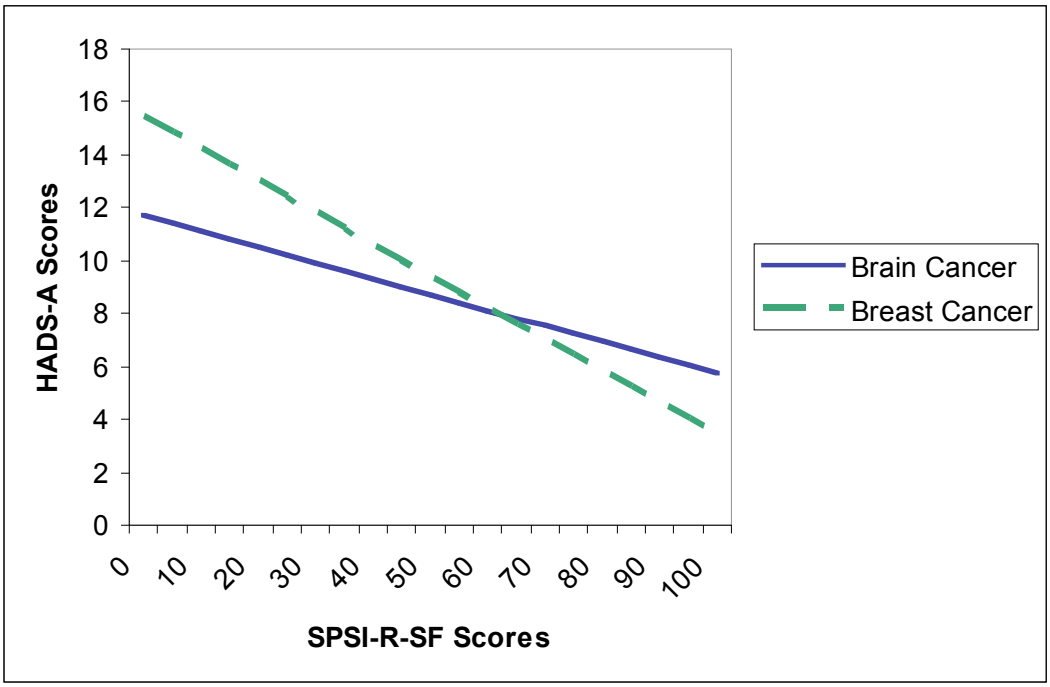
Table 10

Linear Regression Using SPSI-SF-R (Problem Solving) Scores to Predict SF-12 MCS (General Emotional Distress) Scores For Brain Tumor Survivors, After Accounting for Demographic and Treatment-Related Factors, Fatigue, and Cognitive Limitations

Variable	R^2	$R^2\Delta$	B	*p*	95% CI
Block 1: Demographics:	.035	.035			
Gender			-.070	.982	(-6.024)-(5.884)
Education			-1.398	.212	(-3.605)-(.810)
Race			-12.754	.084	(-27.243)-(1.735)
Marital Status			1.373	.380	(-1.711)-(4.457)
Job			1.545	.292	(-1.348)-(4.437)
Age			-.027	.868	(-.344)-(.290)
Block 2: Treatment-Related Variables:	.143	.108			
Years Since Diagnosis			-.005	.988	(-.664)-(.654)
Cancer-Related Medication			5.414	.221	(-.3.299)-(14.127)
Meds for Cognitive Difficulties			7.478	.310	(-7.061)-(22.017)
Mood-Related Medication			-8.236	.040	(-16.084)-(-.387)
Meds for Anemia/Fatigue			-5.841	.480	(-22.165)-(10.484)
Anti-Seizure Medication			4.403	.164	(-1.826)-(10.631)
Other Prescription Medication			-2.405	.430	(-8.426)-(3.615)
Surgery (Yes/No)			7.749	.089	(-1.208)-(16.705)
Months of Chemotherapy			.095	.654	(-.324)-(.514)
Radiation Treatment (Yes/No)			-1.437	.659	(-7.874)-(5.000)
Block 3: Fatigue/Cognitive Limitations:	.354	.211			
Fatigue (MFSI-SF) Score			-1.396	.000	(-2.045)-(-.747)
Cognitive Limitations (CSC) Score			-.125	.148	(-.294)-(.045)
Block 4: SPSI-R-SF Score:	.387	.033			
SPSI-R-SF Score			.315	.013	(.066)-(.563)

Figure 3. Estimated HADS-A (Anxiety) Scores for Brain and Breast Cancer Survivors, by SPSI-R-SF (Problem Solving) Scores, After Accounting for Relevant Demographic and Treatment-Related Factors

Figure 4. Estimated HADS-A (Anxiety) Scores for Brain and Breast Cancer Survivors, by SPSI-R-SF (Problem Solving) Scores, After Accounting for Relevant Demographic and Treatment-Related Factors, Physical Fatigue, and Cognitive Limitations



APPENDIX A: Online Survey

Work Productivity in Brain and Breast Cancer Survivors

(Starts on next page; includes 19 pages)

NOTE:

Hospital Anxiety and Depression Scale: Items 163-176

Social Problem Solving Inventory-Revised: Items 138-162

SF-12: Items 42-48

Multidimensional Fatigue Symptom Inventory-Short Form: Items 108-137

(Items on the physical fatigue subscale are distributed throughout the MFSI-SF and are listed in the "Measures" section of this document)

Cognitive Symptom Checklist: Items 90-107

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